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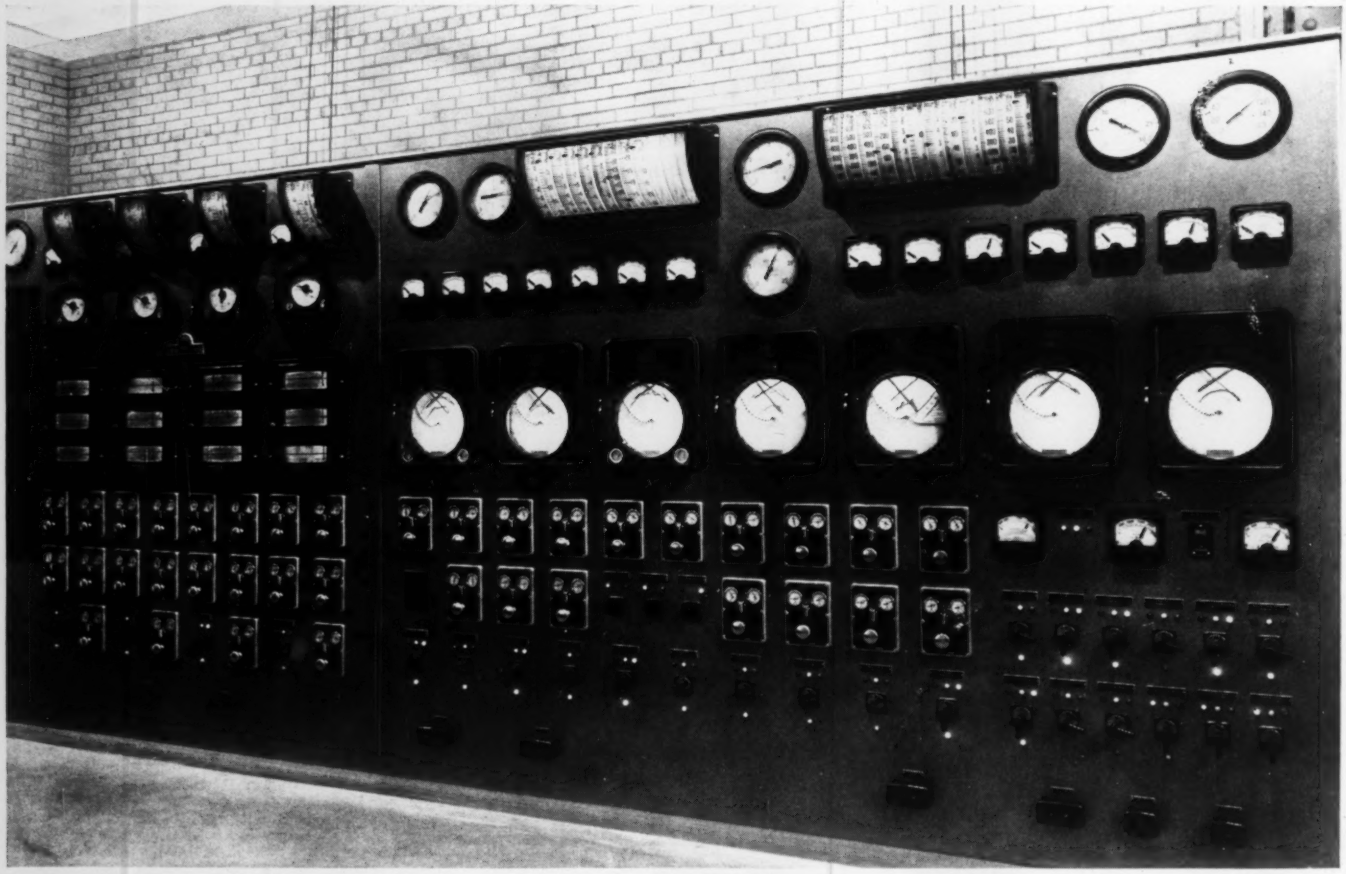

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MECHANICAL ENGINEERING

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VOLUME 64 NUMBER 1

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Two A.S.M.E. Presidents at the 1941 Annual Meeting

(W. A. Hanley, left, is succeeded in office by James W. Parker, right.)

VOLUME 64
No. 1

MECHANICAL ENGINEERING

JANUARY
1942

GEORGE A. STETSON, *Editor*

We Are at War

TO THE credit of W. A. Hanley it will be remembered that during his term of office as president of The American Society of Mechanical Engineers which came to a close last month he covered the length and breadth of the land talking wherever he went not about National Defense but about war. His insistence during the last year that "we are in the war now" attested to the realism of his thinking and the clarity with which he foresaw inevitable events.

By formal declaration we are in the war now, and had more persons believed as Mr. Hanley did, our capacity to face it resolutely and win a complete and quick victory would have been strengthened materially. But among engineers as among other citizens it took the dastardly attack on Pearl Harbor to awaken the complacent, to convince the isolationist of the error of his views, and to achieve a national unity without which no great venture, whether of peace or of war, can be brought about. That unity has now been immeasurably strengthened; and while the right and obligation to state one's own views still exist, a common danger will silence much relatively unimportant comment justified only in times of peace. One can reasonably expect that the miracle born at Dunkirk, which amazed the entire world and even the British themselves, the emergence of latent qualities of fortitude and determination in all sorts and conditions of men consolidated in unswerving unity, will be repeated here.

We are at war. We must and we shall win. We must and we shall work for a better world to live in. To these objectives—the winning of the war and the wise planning for a better world—this Journal dedicates itself.

A.S.M.E. Is Ready

WHAT distinguishes a democracy from a totalitarian state is the self-discipline of its people. For any effective mass effort, leadership with authority is essential; but authority which is derived from the voluntary consent of the people to be led outweighs that seized by a small group and maintained by force and fear. In democracies great movements surge upward from the bottom after the majority have made up their minds upon a course of action. The self-discipline exercised during the period in which people in a democracy make up their minds strengthens them individually as well as their collective efforts. The self-disciplined man looks after himself first—puts his own house in order—and joins with his neighbors or his particular group in expanding his actions, after which these groups come together for national service. With his own decisions made and his preparations in effect, the self-disciplined man has time and courage and energy for greater things. He becomes not a public charge requiring assistance of others but an intelligent vitalized individual prepared for whatever may happen.

The engineer's first duty is to himself, his family, his community, and his job. This in the aggregate constitutes his obligation to his country and to humanity. For more effective use of his disciplined self he must share his specialized knowledge with other engineers and make good use of whatever they have to offer him. To serve as a clearing house of ideas and expert knowledge is the function of engineering societies. This is their first task in times of peace or war. Enlightened self-interest which results in public service justifies the special consideration and high esteem shown to engineering societies by the people and their government. As a body of intelligent self-disciplined men, The American Society of Mechanical Engineers has approached all of its tasks through the voluntary contributions of its individual members. It is in this spirit that the Society converts the actions it has taken in the name of National Defense into greatly expanded actions in the war against the Axis powers.

The 1941 Annual Meeting of The American Society of Mechanical Engineers just concluded demonstrated that the Society was prepared for the war declared before some members had returned to their homes. Its own house has been put in order. Its organization has been on a wartime basis for a year, "streamlined" to perform the tasks ahead without having to discard much of the lumber of peacetime organization. Its finances are in a satisfactory condition. Its membership is growing rapidly. Its meeting and publication facilities have been tuned to the tempo of world-wide war. Like the farm lad in the story told by W. J. Cameron on the Ford Sunday Evening Hour some months ago, it can "sleep on a windy night." And refreshed by such sleep that strengthens self-disciplined men, it can put in long hours of hard work without collapse.

Fully half of the members of the Society are engaged normally in the production industries. Today, this percentage is larger. It will continue to grow as skill and training needed for the supreme effort demand the active participation of every man in one job or another. The genius for production that has made this country great and built up within it the most extensive and efficient manufacturing agencies in the world has been fostered in schools, in plants, and in the Society itself for generations. It constitutes the greatest force for victory today. It will multiply with astounding speed.

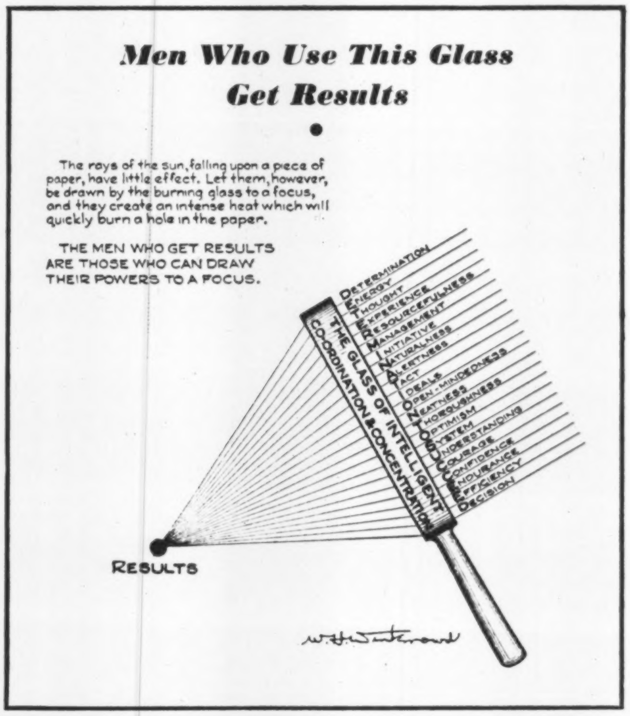
A study of the report of the 1941 Annual Meeting and of the addresses delivered on that occasion, which are published in this issue, will show how keenly sensitive the Society is to the times. Preparation for the war effort was a dominant note throughout the meeting. The four addresses at the National Defense meeting, the case histories covering special phases of conservation and reclamation, the role of the engineer in transportation set forth by Messrs. Young and Dickerman, are alive with useful information bearing on the conduct of engineers in wartime. The A.S.M.E. is ready.

In addition to the marked attention paid to the war it must be noted that the world after the war has not been forgotten. Although major effort must be expended in production of war materials, although our first and most urgent concern must be the winning of the war, we must plan for the future. New devices and new techniques must be developed not only to gain superiority in the fight for victory but to set up a wise and just peace. Workers on the frontiers of science and engineering must redouble their efforts toward this dual objective. We must not lose sight of the possibility of making those desirable advances in an exclusive concern with the immediate routine. Education must be as thorough as the times permit. Conservation and reclamation must extend to human values as well as materials. The corroding influences of hate and revenge must not be allowed to destroy the influences that condition wise statesmanship which will prove sterile if not backed by public opinion. Isolationism, which many knew to be dead with the first World War, must give way to a mode of thought, action, and government that will not permit the seeds of world disorder to germinate again. Values will be refined in the melting pot of an exacting experience. The great democracies must emerge not only victorious, but resolute in their determination to discharge the obligations victory entails. The hungry must be fed. Reconstruction must be undertaken. Unemployment must never again become widespread. Industry and trade must be reestablished in freedom and with world-extensive justice. And above all, the peace must be kept by the power, justly used, that superiority of arms allows the victors.

The A.S.M.E. senses in the minds of its self-disciplined members a determination to see the job through. It is at work upon these problems. It is ready for the war. It must be prepared for the peace to follow.

W. H. Winterrowd

CROWDING into the mind come dozens of incidents and recollections connected with W. H. Winterrowd, vice-president of The American Society of Mechanical Engineers, whose untimely death on December 7 followed unexpectedly an automobile accident that had not promised to be serious. They constitute a rich inheritance for those who knew him, for he has left behind him something of his fine strong self to give courage in weary hours and to stimulate his friends to develop, as he did, a well-balanced and many-sided character.



Men Who Use This Glass Get Results

The rays of the sun, falling upon a piece of paper, have little effect. Let them, however, be drawn by the burning glass to a focus, and they create an intense heat which will quickly burn a hole in the paper.

THE MEN WHO GET RESULTS ARE THOSE WHO CAN DRAW THEIR POWERS TO A FOCUS.

FACSIMILE OF SKETCH MADE BY W. H. WINTERROWD AND USED IN A TALK TO HIS YOUNGER EMPLOYEES

One sees the tall strong figure, feet planted firmly and head cocked a bit on one side, chin drawn slightly inward, one eye, perhaps, partially closed, and a face alight with friendly greeting; or walking down the platform to look at the locomotive that was to draw his train; or leaning over a table, glancing around at the friends gathered there, and as likely as not telling, with great effect and probably in the vernacular, a railroad story, or an incident of revolutionary days in Russia. One feels the clasp of a hand that worked skillfully with tools, that wrote kindly letters of greeting, or congratulation, or sympathy, in a round clear script, or that handled with a collector's pride a rare item from his private library.

One thinks of him too as personifying the three G's—goods, guts, and gumption—that he used to talk about to young men; recalls his interest in good citizenship, how he made himself a part of every community he lived in, the custom he had of giving copies of the Constitution of the United States to every pupil graduating from the high school, the prizes he established at Purdue. One remembers how he combined technical and administrative skills, sound discipline with a keen personal interest in every man in the shop.

Of engineering achievements a record will be made in another place. It was the man himself that made the strongest impression, a personality so real to the consciousness of his friends that it remains the finest thing about him.

AMERICA MUST DECIDE

By WILLIAM A. HANLEY

PRESIDENT OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

WE ARE now concerned largely with the winning of the war and this will be our foremost task until victory has been achieved. Our first responsibility in this world catastrophe is to our government. We therefore unequivocally pledge that with loyalty and patriotism members of the engineering profession will give unstintingly of their time, their talents, and their labors, until the pledges of our government have been carried out and peace is restored on earth.

Although the war is our immediate problem we should begin to think about our situation when the war will be over, and as far as possible, we should plan for those uncertain days ahead. We should do some realistic thinking and some definite planning.

We do not know when the war will be over or what conditions may exist at that time. Our situation will not be what it was at the close of the World War. All the world, including ourselves, will be much poorer. When we entered the last war our federal debt was less than two billion dollars, and our government had lived within its income for many years previous to that war. When the World War was over our federal debt was twenty-six or twenty-seven billion dollars, and in the following ten years we reduced this debt to sixteen billion dollars. We are going into this war with a federal debt of fifty billion dollars; we will emerge from the war with the debt of possibly one hundred billions or more. We have not lived within our income for ten years. It has been truthfully said that "dictators are the receivers of bankrupt republics," and we want neither bankruptcy nor a dictator.

Although the lease-lend program has my unqualified approval, it is my opinion that we shall get back little, if any, money or materials in repayment. We must realize that England went to war with a debt of nearly one thousand dollars per capita and has been spending upward of fifty million dollars per day. France, Holland, Belgium, Poland, Germany, Italy, Spain, China, and Japan will be desperately poor at the close of the war, and probably through necessity, will be seeking financial help for many years thereafter. This is the picture we must face. If the World War I produced a crop of communists, socialists, and people clamoring for a change of government, what may we expect after World War II when the world had not recovered from the effects of World War I? Crowned heads dropped and governments changed rapidly as a result of the last war. It will be true again after this war. We must be prepared for terrific social changes in Europe, and we must realize that we are not immune to such influences in our own United States. It could happen here. It may happen here.

If we in the United States are prepared for the trials ahead and if we are united in our efforts, we can undoubtedly weather the storm and come out less damaged than if we neglect the danger signals. We can either, as a united people, lead the world by example through this dangerous period, or we can wallow in the trough of the sea, without chart or compass, to be buffeted by the winds of political and social conflict and finally wrecked on the shoals of internal strife.

The National Resources Planning Board estimates that in 1944, if we are still at war, we shall have twenty-three million workers on defense projects and three and one-half million men under arms. This means that of fifty-five million workers in the United States, nearly half of them will be on defense or wartime effort. The colossal undertaking of putting these workers back into peacetime employment when this emergency is over is our great task.

This problem should not be underestimated in scope or in the time required to bring about the change. The job looks bigger than first appraised when it is remembered that never were there less than eight million unemployed between 1930 and 1940, when pump priming and government peace spending reached all-time highs. After the war there are two ways for our people to obtain jobs. One is in private industry and the other is to work for the government. We must decide from which of these two ways these jobs are to be created. Do we want a government, loaded with debt because of prewar and war expenditures, to have fifteen or twenty million workers on W.P.A. jobs and in C.C.C. camps? If that is our idea of postwar jobs for our people, then we had better send some observers to Europe for we shall surely find ourselves following down that path which led Italy to Fascism. The alternative is to prepare now to create jobs in private industry, and to plan to reduce government employees to a bare necessary number. If all the men and women in America will become interested in this postwar employment and will individually adopt a policy to help in the solution, we can solve the problem and America can thrive as she did thrive from 1790 to 1930. The solution lies with individuals to a greater degree than it does with corporations, municipalities, or other groups. As individuals, as corporations, as cities and states, and as a nation we should reduce our peacetime expenditures now, so that we can accumulate money to spend, and then spend it when the war is over. Accumulate needs and money now. Satisfy those needs and spend the money when the war ceases. If we could have ten million orders for new automobiles in the first two years after the war, it would be very helpful. If the majority of car owners will drive their cars twenty-four months longer than has been their custom, then we shall have the ten million orders for automobiles. As a patriotic duty, to save this nation at home, to save our form of life for ourselves and our children, to avoid Fascism, we should not only have this demand for ten million new automobiles but for great quantities of goods and commodities which must be produced by labor. We should accumulate the need for clothing, home furnishings, and new equipment for homes, and in addition accumulate the need for several million new homes. Millions of men can go to work on these jobs alone, if this backlog is provided. There may be some personal inconvenience in such a program of waiting, but surely the sacrifices will be greatly repaid in helping create a staple economic condition in America. In the same way the commercial organizations should have an accumulation of man-hour projects which have been postponed until the war is over and then should carry forward such projects fearlessly to assist the job program. The town and city should, where possible, postpone the paving of streets, building of bridges, municipal buildings, extension of utility services, and the like. In like manner the respective states might well postpone as far as possible the paving of roads and repairs and additions to state institutions. The churches, schools, hospitals, and nonprofit corporations

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An address delivered at the Annual Meeting, New York, N. Y., December 1–5, 1941, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

can all contribute to this great effort of accumulation, and if we will all do our part, the W.P.A. and the C.C.C. can pass into history.

During World War I several million women were absorbed into industry. Most of these women returned to their homes after the war to take up their duties as homemakers. More than one million, however, never gave up their jobs; and it was one of the contributing factors to the great depression that these women were filling jobs which might have gone to men. This error should not be repeated. Where there is a man in the family he should be the breadwinner and his wife should be what she has always wanted to be, the homemaker. His income should be sufficient to support his family without his wife's working.

LET PRIVATE INDUSTRY PROVIDE JOBS

There are now, and will continue to be, powerful groups who feel the government should extend its field of employment and that private industry should shrink accordingly. In times of war there is no other practical scheme, but in times of peace governmental employment, except in vital functions and in great emergencies, should be tolerated only as visioned by the founders of this Republic. Whether this nation or any nation can long survive with half the workers on governmental pay rolls and the other half in private enterprises has yet to be demonstrated. Because of the demands of the war and in preparation for the job situation at the close of the war, the federal government should as rapidly as possible cease its efforts except in defense and in vital governmental functions. If there should ever be a Florida ship canal or a St. Lawrence waterway development they should only come when they are proved necessary for national defense or can be justified as a good business venture, and once all our workers are employed every governmental undertaking should be subjected to this searching scrutiny. Let the jobs for the postwar period be created by someone other than the federal government and then the government can be relieved of this responsibility. Many federal boards, commissions, bureaus, and agencies will hang on attempting to enlarge their fields and their influence and will organize blocks of voters who will pursue certain selfish objectives. These must be recognized and dealt with on the basis of the public interest. If individual enterprise will supply the jobs for our workers, and the federal pay checks will become less and less, then our people will more carefully, and with more independence, evaluate every governmental service paid for by the taxpayers. When the people are concerned more with the expenditures of their government and less with what they can personally or in groups siphon out of the public treasury, we shall again have reached a high degree of public responsibility. If we will produce the jobs for our people and will get them off the governmental pay rolls, we shall have the key to the situation for maintaining the system of private enterprise.

The federal government will have problems aplenty even though private enterprise employs all the workers. World stability alone will take the most patient and careful planning after a war-torn and bleeding world has laid down its arms. Let us then save our government from an internal struggle that would only add more difficulties. The war itself will create a lot of new problems in America and these must be reckoned with. In the first World War we had four million men in uniform. We have many of these men incapacitated today. We face an eventual pension for many of these four million men. We had a soldiers' bonus. Shall we have three or four million more after this war to add to the previous millions for whom we may be obliged to provide pensions and bonuses? Our soldiers should and will receive consideration for the great sacrifices they will be called upon to make.

Shall we continue to subsidize agriculture to the extent of one billion four hundred million dollars as we are doing in this fiscal year? This is a new subsidy created almost entirely since World War I.

Shall we continue to pay seventy cents an ounce for newly mined silver as a subsidy to a half dozen of our Western states, when the world price of silver is thirty-five cents an ounce?

Can we run on an unbalanced budget forever without going bankrupt?

Will nine million people in labor unions, paying into these unions an estimated two hundred and fifty million dollars per year, accept the regulation and group responsibilities as have other powerful economic groups, such as the insurance companies, the banks, the railroads, and the stock exchanges? Will the labor unions resist the open accounting and corporate legal responsibility which must always be accepted by those having great financial, economic, or political power?

There are large numbers of workers in certain industries who would like to see the government take over such industries now and the workers become permanent government employees. These and many other problems confront our government and the manner in which we shall solve these problems will largely determine our future way of life. Every war causes certain reactions and one of the reactions of the last war was the creation of a philosophy that government could and should solve every single problem with which individual citizens may be confronted. All over the world self-reliance has been largely discarded. Thrift and economy and such virtues, which were so advocated in the three hundred glorious years following the Pilgrims' landing in 1620, have not been accentuated in this country for a generation. We must re-examine and reinstate the philosophy which achieved our success in the past. The hope to continue a high standard of living for our people can be supported only by a firm determination to have greater production of goods, at continually decreasing prices, and this means individual enterprise and work and a self-supporting population. How the employment situation is handled at the close of this war will greatly determine whether the government is to be the employer of most of the workers in the future, or whether individual enterprise will carry on. Shall we have regimentation or liberty? If it is regimentation and if the government largely prescribes our way of living, then representative government will not be long in passing.

LET US MEASURE UP TO OUR RESPONSIBILITIES

We can do our part, beginning right now, to create our individual list of wants, which we will postpone until the close of the war. Let us measure up to our responsibilities in not only winning the war but in winning the peace, and in so doing continue that way of life for ourselves and our children as we received it from our parents and from those who, through great sacrifices, created it for us. This country has gone through many crises; surely in this one, when we hav the stewardship, we shall not fail. We want the historians of the future to write that representative government and individual enterprise produced the highest standard of living in the United States ever before attained in all time. We do not want those historians to record that representative government and individual enterprise failed under the strain of two world wars in one generation and, as a consequence, are only a memory in the history of mankind. Men have died and today are dying for these causes. Surely we will fight with all our strength to preserve them in these United States. Let us prepare now for this employment situation with a program that will lead America to a sound, enduring, economic freedom and not follow an unknown and uncharted path where the winds of destiny may destroy us.

WHITHER INDUSTRY *in* DEMOCRACY'S ARSENAL

By DONALD M. NELSON

EXECUTIVE DIRECTOR OF THE SEVEN-MAN SUPPLY PRIORITIES AND ALLOCATION BOARD, WASHINGTON, D. C.

WHETHER we as a nation know it or not and whether we like it or not, we are engaged in a grim struggle which pits our inventive genius and our production ability against a determined and altogether too able an adversary.

It is trite to say that this war will be won on the production lines. Wars are always won by having more and better matériel than your enemy. And, incidentally, let us not lose sight of the fact that second place in a war with Nazism is a fearful thing to think about. Our nation has said in no uncertain terms that it does not want to be second to any possible combination of enemies headed by Hitler.

JOB OF REARMING UP TO INDUSTRY AND LABOR

That puts the job then of rearming up to us—industry and labor alike. And we have the most stupendous job to do, a job that even staggers the imagination.

In ordinary times, the man who is going to be responsible for bringing out a new product does not make the saving of material a primary consideration. He concerns himself with the appearance of the product, with its decoration and finish, with the efficiency of its performance, with its durability, and with the ease of its manufacture. He is of course anxious not to waste any material, because waste is costly; but he does not sit down to his job with that idea of saving material uppermost in his mind. Materials have always been plentiful in this country. During the last decade there have been times when they seemed too plentiful for our own economic good. Very seldom did the designer look on the saving of material as an end in itself. Profitability of operation has always been the dominant objective.

The present emergency, however, has drastically changed all of that. Our problem now begins with the material itself. We first figure how to make as many usable products as possible out of a given amount of material; after that we give such attention as we can to the attractiveness and marketability of the product. In all cases where the use of a critical material is involved, these considerations become secondary; in some cases they may even become nonexistent.

Hence the emergency gives industry an extremely difficult problem. It requires us to reorient our ways of thinking. It is only natural for the businessman to prefer to follow the approach he is used to; in most cases, probably, he can change his mental attitude only by forcing himself toward the necessary reorientation. Furthermore, the risks involved in trying out new ways and means of making things are necessarily very high during this emergency.

They are high because time is one of the innumerable things of which we do not have enough. Ordinarily, when you introduce a new design or a new process you have a chance to try it out. The trial period brings out the kinks; you iron them out and try it again. You get, in other words, a certain period for trial-and-error testing. In this emergency that period just isn't available. The thing has got to click from the start.

In the second place, the product will very probably face a stiffer test than it faces in ordinary times. That certainly is true of anything produced for military use. Our military products must, above all else, efficiently meet the test of satisfactory performance.

So it adds up to a hard job. Yet it is not an impossible one. There is good reason to believe that in other countries the necessary reorientation in attitude toward the use of materials has already gone very far. Great Britain, Germany, and Russia have provided numerous and often surprising results from their attempts to effect both a saving of materials and a maintenance or even an increase in the efficiency of the functioning of the products. In this country, of course, the problem is newer. I am glad to report that a good deal of progress is being made; but I must insist that it is of the utmost importance to make much greater progress, and to make it with all possible speed.

Now there are obviously two general classes of products in which the need to produce more units out of less material is urgent. The first class is composed of things that will be used in military service and in actual combat. The second class includes all the things that won't be used in combat, whether they are produced for military use or for civilian use. It is of course clear that you can't lay down any general rule, covering both of these classes, concerning the extent to which efficiency may be sacrificed, durability may be impaired, and attractiveness diminished. For some we may have to resign ourselves to lower standards of efficiency, durability, or attractiveness than we would like; for others, we may have to insist on a high level of efficiency at the cost of either or both of the other two qualities. But in any case it is clear that readjustments must be made on an ever-increasing scale; and while it unquestionably is true that in many cases both the durability and the efficiency of the end product must suffer, it remains a fact that the degree to which American engineering and inventive genius can succeed in maintaining or even employing former standards of product quality will constitute one of the tests of our mechanical prowess as a producing nation.

DESIGN AS A BASIS FOR BEST USE OF MATERIALS

I believe that the most sensible way to discuss this question of the greatest possible utilization of materials is to approach it from the viewpoint of the design of the product.

Thus we can restate the problem in general terms about as follows: How can we best bring to focus upon the desks of our engineers and designers every available bit of scientific knowledge, and the imaginative application of that knowledge?

With the rapid progress of scientific research, I venture to believe that there are innumerable opportunities for new combinations of materials and new applications of knowledge which can be worked out to help us in this major attempt make the very best possible uses of our available materials so that we can win a war and still keep our economy sound.

This matter has received abundant attention from the gov-

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ernment, and the engineer or designer who approaches the problem will find many government sources on which he may draw for help. I should like to spend just a moment describing just what the government has done to make easier the focusing of science, knowledge, and imagination on increasing the quantity of goods that can be made from a given quantity of scarce material.

GOVERNMENT AGENCIES CONTRIBUTING TO CONSERVATION

There are many organizations contributing to the conservation effort. In the Office of Production Management, the principal coordinating force is the Bureau of Industrial Conservation, under Mr. Lessing J. Rosenwald. This Bureau addresses itself to helping in the revision of federal specifications, the initiation of simplification programs in industry, the reduction of waste, and the salvaging of critical materials. It stands ready to give industrialists advice in regard to the substitution of less critical materials for those withdrawn from civilian use, and to suggest alternate processes. It serves as a channel for the transmission of information on new products, new processes, and inventions, from the O.P.M. and other interested government agencies to the world of business. Within O.P.M., the Bureau is assisted in these tasks by the various commodity branches, the Defense Industry Advisory Committees, and the Consumer Division of the Office of Price Administration. The Bureau, in fact, depends upon the commodity branches to carry out the principal responsibility for determining the need for conservation and for advice as to the most practical methods of achieving it.

The Bureau also maintains liaison with the National Bureau of Standards. The latter is particularly helpful in simplification of products, and has assigned Dr. Edwin W. Ely, chief of its division of simplified practice, to work with the Conservation Bureau. The Bureau also keeps in close touch with organizations within the Army and Navy which are interested in conservation through specification revision. Both the Army and Navy have conservation sections. The various supply arms and services within the Army make monthly reports of progress to the Conservation Section, and continuously study specifications which involve strategic and critical materials, with a view to revision wherever possible. Each of the supply arms and services has a liaison officer attached to the Conservation Section. The Section, through these officers, sends on to the supply arms and services suggestions received from the O.P.M. and from the National Academy of Sciences.

The Army's interest in conservation, however, is not limited to the internal revision of specifications. Wherever possible, its officers help manufacturers to shift their materials and processes, so as to permit more efficient use of materials. This is a particularly fertile field in instances where specifications stipulate required performance, rather than all the details of design. The Army also initiates conferences with industry to discuss ways and means of fitting substitute materials into Army procurement programs. For example: The Army Air Corps recently held at Dayton, Ohio, a conference to which it invited members of the plastics industry and representatives of interested government agencies, for the purpose of agreeing on specifications of various plastics. A detailed discussion was had of such things as tension, compression, shear, bearings, fatigue, hardness, durability, and so on, as applicable to plastics; and the meeting succeeded in laying the necessary groundwork for proper comparison and evaluation of the products of research in plastics.

One of the most important projects from the standpoint of our economy which General Charles M. Wesson, Chief of Ordnance, U. S. Army, has under way today has to do with the search for a substitute for brass shell casings. As you of course know, civilian industry today is suffering from an acute copper shortage, due to the huge requirements of defense; and one of the major items in defense requirements is for brass to make shell casings. Forty per cent of our guns are designed for brass shell casings. Substituting steel casings, or casings made of any other metal, which does not expand and contract at and immediately after the moment of explosion precisely as brass expands and contracts, would simply mean either a blown-out breech of the gun or a "frozen" casing which could not be extracted. The Army is working hard to find some substitute for brass—probably a combination of steel and brass—which can be used to replace the present all-brass casings. It is making excellent progress. I believe it will presently find a solution. When that occurs, a very great step will have been taken to ease the strain on our copper supply.

HOW TO CONSERVE MATERIALS

So much for the organization. How about actual accomplishments?

Much has been done in the field of substitution; much of the revision of government specifications falls within this category, and hundreds of specifications have been changed to reduce or eliminate the use of such critical materials as aluminum, chlorine, chromium, copper, and cork—to mention only a few. The Army Quartermaster Corps was able in a period of four months to reduce its requirements of copper for 1942 from 150 million pounds to 40 million pounds. Silk has been eliminated from thread and neckties. Wood furniture is being substituted for steel in many cases. Laundry equipment is now made of wood instead of Monel metal and stainless steel.

Industry, of course, has also been active in substitution. Instead of having aluminum household products, we are now beginning to use enamelware, flameproof and heatproof glass, cast-iron utensils, and earthenware in increasing quantities. Rayon is being substituted for silk in hosiery, particularly in the tops and feet. Some 40 thousand tons of brass, cast iron, lead, and copper are being saved annually through revision of existing plumbing-code standards in defense housing.

Much can be done without any change in design, simply through the simplification of line. Many concerns have a much wider variety of items than the consumer economy really requires. Large savings can often be made simply by dropping from a line of goods those items which require the largest amounts of critical materials per unit produced. A case in point is that of the refrigerator industry, which in the past has had de luxe, standard, and economy lines. Eighty per cent of its business is done on 20 per cent of this industry's complete line. This industry has already agreed to concentrate on the production of the economy line, thus permitting the production of equally serviceable but less decorative units with the same amount of material.

A final method of conserving materials without changing the specifications of the end product is through avoidance of manufacturing waste. This can be done in two ways—by reducing the percentage of rejections of finished products, and by better recovery of scrap materials within the manufacturing plants which use them—better still by making less scrap.

It is hard to overemphasize the importance of the work which industry can do in all of these fields. But at the same time, it is important that we do not let our emphasis on this point blind us to the situation which we are facing. Even with the utmost that can be done in the way of making more out of less, the unfortunate fact remains that these material shortages are going to be very acute.

That obviously means, for one thing, that the supply of all of these materials must be increased wherever and whenever it is possible to do so. An honest and effective effort has been and is being made in that direction, all along the line; in most cases, I am convinced, the government has done the best that could be done to make greater supplies of the critical materials available, and I assure you that we will be glad to be shown any way in which any of the expansion programs could be improved. Yet I would like to suggest that this is a good time for the adoption of what we might call an engineering attitude by industry in regard to these expansion possibilities. By that, I mean that where it is a question of expanding the production of a critical material, the problem should be approached first from the viewpoint: What is the maximum production which it is physically possible to achieve? Taking that viewpoint is the only way to get a valid standard against which the expansion program can be measured. After that viewpoint is taken, all of the other considerations can of course be reviewed and given their proper weight; but during this emergency we must shape our approach to the problem by the engineering standard rather than by the ordinary standard of profit and loss.

And the fact that we are not going to be able to get completely around these shortages, finally, means an over-all change in our national productive system, for the duration of the emergency. We must produce an unparalleled quantity of war goods; we also face an unparalleled demand for civilian goods. The two demands together far outrun our total productive capacity. That will continue to be true even after we have made all of the savings that can be made in the ways we have just been discussing. Consequently we face the iron necessity of concentrating on the more essential kinds of production, whether they be civilian or military, and contracting the less essential kinds. We may be able to have both guns and butter, but we can't have both guns and gadgets.

The period just ahead of us is going to be a trying one for all of us—there is no question about that. Yet it need not be discouraging. I know of a great many problems that must be solved during the near future—I know of none that are beyond our ability to solve if we make a united effort. The great gains which this nation has made in the past were all made the hard way. We can take the hard way this time and get through without faltering—and when it is all over, I am confident that we shall find that we have truly made, in the interest of all our people, one of the greatest gains in our history. Industry *will not* be weighed in the balance and found wanting.

ERIC SJÖLIN

(Photograph taken by F. D. Whisler and shown at the Sixth Annual Photographic Exhibit held during the A.S.M.E. Annual Meeting, December 1-5, 1941, New York, N. Y. See page 65 for awards.)

PROFESSIONAL DEVELOPMENT *and* RESPONSIBILITY

By ROBERT E. DOHERTY

CHAIRMAN, ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

AT THE Annual Meeting of The American Society of Mechanical Engineers in 1966 someone will present a paper on what has happened during the twenty-five years since the United States entered World War II. It may recite how engineers, along with professional men from other fields, broke away from their traditional attitude of professional self-sufficiency, stepped into the rapidly widening breach on the social and economic front, and helped to save America. Or it may recite how engineers, along with other professional men, kept their eyes so steadily focused on status quo, clung so tenaciously to their traditional and interesting business of giving the country a technological joy ride, that they completely lost sight of facts that were vital. They forgot that they were, after all, living in a democracy; they overlooked the fact that if the people do not determine policy affecting their welfare, democracy must vanish; they did not recognize that the activities and interdependence of groups in the national community had become so complex that the nation could no longer entrust its destiny as completely as in the past to emotional oratory and ignoble politics; they forgot that society had given them the privilege of higher education, and thus presumably greater competence to struggle with problems, and that therefore they had a commensurate responsibility for active interest and leadership. They lost sight of these vital facts. In other words, that paper—if indeed one can be given at all in such a case—may accuse our generation bitterly and with justice. It may say, "These men took things for granted. They forgot that they were trustees. They let us down. They forfeited freedom."

I do not know which of these papers will be read twenty-five years from now. It will depend upon what professional men do in practice and in education during the years immediately ahead. The engineer's part is a very important one, and it is my purpose here to outline my view of the situation and indicate what seems to be the clear responsibility of his profession.

POSTWAR WORLD WILL BE NEW ONE

After the war we shall live in a new world. It will be a world requiring fundamental readjustments in our thinking and in our way of national life. Indeed we are already well into that world and are advancing further into it day by day. To understand that all of this is so, we need not depend wholly upon the almost unanimous conclusions of serious students; we need only to look about us. Intense social stresses, widespread confusion of purpose, and gross abuse of privilege are all too evident. National action has leaped far beyond national thinking. The simple fact is that this country is set up under a theory—the theory of individual rights and democratic procedures—and there is, after all, a limit to the extent to which that theory may be contravened. To go too far is to crack up. Flexible as history has shown the theory to be, there is yet a limit, as was demonstrated, for instance, in 1861. And since we have been rushed from our simple beginnings into the new, complex world, impelled first by technological development and now thrust headlong by the demands of war, we have got to accelerate our thinking to keep pace with our actions or we shall again stretch our theory beyond the breaking point. We must readjust our thinking and our attitudes regarding national and community life to bring these again into workable accord with our theory of democratic government; else there can be no lingering remnant of justification for the assumption that, as a nation of once free people, we are still capable of intelligent action, or worthy of freedom.

HOW CAN WE INITIATE READJUSTMENTS?

How can these readjustments be initiated? Whose responsibility is it to plan them? From what I have already said my answer is clear. Professional men must undertake the task. One need not labor the point that, as a matter of right, they *should* do so because they have had privileges of education denied to others. The fact is that nobody else *can* do it. The problems are too complex. They involve the establishment of new interconnections—lines of communication and understanding—between fields of human activity that in the past have been held separate. The problems of sociology, economics, and technology are no longer merely technical in nature. The technical aspects of the problems in each of these fields are indeed difficult enough, but there are new elements to be recognized, new complications beyond those considered in the past. One is the imperative necessity now of recognizing more fully the interdependence of situations in these different fields. For instance, the technical problems of economics and the technical problems of engineering involved in the design of a piece of apparatus have of course usually been coordinated in the past, but the sociological problem created by the introduction of the apparatus into social use has not been adequately taken into account. Or, the other way around, a sociological problem—say, the employment of idle people who want to work—may not be solved because the technological or economic problems concerned are not solved. In other words, we have reached a stage, as I understand it, where the interdependence of situations in these different fields must be recognized. Human life is not divided into subject-matter compartments; we can't continue solving one part of the problem and thinking we have solved the whole; we must actually *solve* the whole. Then another complication is the necessity of readjusting our philosophical base. Merely recognizing the interdependence of situations is not enough. The solution of these problems, if there is to be one, must be geared into a principle. That principle is not new; it is just forgotten—the principle of individual rights and democratic procedures. If our national problems are to be solved, the parts must be related to the whole and this relationship must be made to accord with this fundamental principle of our existence as a political unit. And the intellectual task involved in the initiation and consummation of such a complex national readjustment is one in which professional men in all fields—including the social and physical sciences, the learned professions, business, engineering, industry, labor—are obliged

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A report presented at the Annual Meeting, New York, N. Y., December 1–5, 1941, of The American Society of Mechanical Engineers.

to assume leadership, and obliged also to recognize, even in this process of assuming leadership, the principle of democratic procedures.

Among the professional men who should undertake such a task, the engineer has a heavy responsibility. I have said elsewhere: "A technological war is raging in a technological civilization. It is based on the engineer's work. He is conversant with the mechanical, chemical, electrical, and structural bases of both civil life and war. He plans mills and machines; he executes their construction; he employs and manages the men who do the work. He is responsible, in other words, for seeing that plans on paper become actual material things that work, and also that the job is done on time within estimated cost. On the other hand, he has not had in the past either responsibility or great interest as to what the social effects of his work would be. It is idle to censure him, as some do; and it is equally idle, I might add, to censure social scientists and business and political leaders who did have the responsibility and presumably also the interest. That water is over the dam. But in the future the engineer must enlarge the scope of his view and take an active interest, both as an educated citizen and as a professional man, in the problems of national and community life where his creations have so completely changed the environment and way of life.

"There are two things he can help to do, both of them immediately urgent. One is to create employment for the post-war period. After ten years of increasing population and increasing invention and discovery, yet of curtailment in most areas except government activity, the possibilities of constructive enterprise appear boundless—new materials, new products, new homes, new structures, new machine tools and methods, new services, and so on. Every engineer in the country, whether he be at the design table, in the field, in the laboratory, or in the plant; whether he be superintending construction, managing a factory, or running a business—wherever he is, every engineer should be figuring out what *he* can do *on his job* to provide constructive employment. His position may or may not carry decision, but he can at least think and suggest, and in many cases he can decide upon action. Seventy-five thousand trained minds turned upon the problem can bring results; and those minds can be reached and oriented through the professional engineering societies."

ENGINEERS CAN HELP IN EDUCATION

The other thing engineers can do is an educational job. It is to develop in their younger brothers and themselves a new understanding of their professional obligations to society, and the capacity and knowledge to discharge those obligations. This is a long-run undertaking, but time is nevertheless an element. One hopes that in the next generation of engineers there will be more who through education and interest are in a position to sit in policy-making bodies and thus help to guide the use of the engineers' creations, more who as teachers can help young engineers acquire the broader view of their professional responsibility, more who as educated men can recognize and support constructive political measures and oppose destructive ones, and help other citizens to understand complicated situations and issues. We cannot wait two or three generations; we must begin now, because the educational undertaking to which I have referred properly should begin in college. The foundation of knowledge and of incentive must be laid there. But the educational process we are considering, like the student's other professional studies, cannot end with college; it must continue afterward. Hence, in our emergency the process of education to prepare the young engineer for his new obligations should be begun at once both in the colleges and among practicing engineers, especially those recently graduated.

It is here that the responsibility of the organized engineering profession is absolute. Engineers individually cannot be expected to assume, on their own, these new responsibilities. I think I am right in saying that to bring about readjustments in interests and attitudes requires, even in younger people, unremitting guidance and attention, and in mature minds I have not yet fully learned what it requires. But if we are going to help the younger generation of engineers to prepare themselves for the job that is ahead of them, we must provide an *organized* educational movement. This movement will necessarily sweep across the entire range of functional organizations of the engineering profession, including the educational, legal, and practicing. In other words, to accomplish the purpose, it would appear that nothing less than a cooperative movement on a grand scale is required.

WHAT ARE THE NECESSARY STEPS?

What, then, are the necessary steps in such a movement? The first is to bring about a full understanding of the problem, its vital importance and urgency, among the boards and executive officers of those national organizations concerned with engineering, and the acceptance by them of a plan of action. The second is to put the plan into execution. May I outline to you how I think these steps might be carried out?

Fortunately, the machinery already exists for doing the job; no new organization is necessary. The national engineering societies, The Engineering Institute of Canada, and the Society for the Promotion of Engineering Education have local organizations through which the individual engineer and the individual student are reached. The National Council of State Boards of Engineering Examiners represents the local State Boards that deal with the legal side of engineering. Then there is the central conference body of all these groups, the Engineers' Council for Professional Development, which can provide such coordination among the groups as may be necessary. As I see it, the role of this central Council of twenty-four members in the whole undertaking would be thinking, planning, and conference. The undertaking is distinctly one of professional development. The members of the Council would bring to the conference table the best of what each group has to offer and what the Council's own Committees can contribute, and then by debate and deliberation and by consultation of Council members with their own organizations, work out for the purpose we are considering a coordinated plan that will fit into the existing programs and machinery of the Council and that will have the support of the constituent groups.

The support of the several groups is absolutely essential, not only because they must approve any important project before it is put into effect, but also because the constituent bodies are the ones that will have to do the job. Although there are a few undertakings which the Council itself has been authorized to administer—the accrediting program, for instance—it seems perfectly clear that an educational program such as the one here contemplated must be carried out by the constituent organizations. The function of E.C.P.D. would be merely coordination of the effort through the Council's standing committees.

In short, then, the role of the Council would be coordination of planning and effort; and the role of the constituent bodies, the execution of plans. May I now say a more specific word regarding these roles?

I visualize in some detail a picture that has been taking form during the past few years of the machinery of national professional development. Some parts of the machinery are already in place and in motion, and others are being constantly added and put in motion. The problem is to complete the picture—to provide the links that are still missing, get all the parts in motion, and then gear them together in one effectively coordinated movement. Need I add, incidentally, that not an insignificant part of the problem is to accomplish all of this without stripping any of the gears? I have come to visualize this picture in increasing detail because several hard-working members of E.C.P.D. and its standing committees have been sketching in those details. And among these people, there is one who has been especially active and helpful in sketching the whole. I refer to that Socratic catalyzer, Dr. Charles F. Scott. From his unique vantage point—having served as head of the American Institute of Electrical Engineers, of the Society for the Promotion of Engineering Education, of the National Council of State Boards of Engineering Examiners, of the Engineers' Council for Professional Development, and of the Connecticut State Board—he has dreamed professional development, pondered its problems, hammered unremittingly with searching questions his associates in all of these widespread interests, and made them—if by no other means, then by exhaustion—give him an answer. One phase of his genius is the bringing of miscellaneous ideas into constructive combination and seeing that people know them. And partly out of this catalytic process has emerged a picture of how the existing machinery of engineering organizations can be utilized to accomplish professional development in general, and therefore also the specific purpose we are here considering.

One visualizes lines of flow for ideas and plans from the several headquarters of the engineering societies to engineering students through the respective student branches, and to practicing engineers through the local sections; and from the S.P.E.E. headquarters to the engineering teachers through its local sections. Also one sees crossflow on campuses between the several student branches and the local S.P.E.E. sections or groups, and in industrial centers between local sections of the engineering societies. Then there is the possible line to engineers entering practice through the N.C.S.B.E.E. And the headquarters of all these agencies are tied together for coordination in the E.C.P.D. Thus the machinery exists all the way through. It needs only to be put to greater use for the purpose of professional development, including our present problem of cultivating a new understanding of professional obligation.

Can we not begin at once to utilize these available means to bring about this new understanding among engineers of the problems that face the country and of their responsibility to take a hand? Can we not bring them to realize that all of them can help individually by thinking and planning how to create employment after the war and then doing what they can to get their thoughts adopted? And can we not—must we not—look ahead at least a generation and take responsibility for helping the younger generation to understand and prepare for the professional life and service that are ahead of them? Cannot the responsible heads and boards of engineering organizations—indeed, cannot The American Society of Mechanical Engineers take the necessary initiative to get this thing going? Then perhaps the paper at the annual meeting in 1966, reviewing the twenty-five years since we entered World War II, will say, "Engineers recognized their responsibility and did a magnificent part in saving America."

"DR. JEKYLL"

(Photograph taken by George G. Hyde and shown at the Sixth Annual Photographic Exhibit held during the Annual Meeting, Dec. 1–5, 1941, New York, N. Y. See page 65 for awards.)

SCIENCE *in the* DEFENSE PROGRAM

By FRANK B. JEWETT

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FOR fifteen years following the first World War there were frequent articles on the probable role of science in future warfare. While this was quite natural in view of the part played by the airplane, the tank, and lethal gas in the titanic struggle of 1914–1918, the articles in the main evoked interest rather than concerted action directed toward full employment of science in preparation for more widespread and more deadly warfare.

Despite the fact that the decade and a half following the war was a period of the most productive activity in fundamental science research and of intense effort to apply old and new knowledge promptly in industry, this *laissez-faire* attitude in the military sector was largely a reflection of men's attitude generally toward war. The weariness of the struggle and the distaste for carnage and destruction, coupled with a naive faith that men had learned finally the lesson of war's futility, gave rise to the era of small appropriations to the military, to disarmament conferences, and to the League of Nations and similar efforts to organize the world for a settlement of international controversies by reasonable methods rather than by recourse to mass murder.

PEACE EFFORTS OF 1920'S RETARDED DEFENSE SCIENCE

In the United States particularly, the decade of the 1920's saw this carried to the extreme. Warships were taken to sea and sunk or were laid up and the Army was reduced to the status of a moderate-sized police force—a force so small and scattered that no really effective training or development of radically new implements could be had. Appropriations were cut to the irreducible minimum of maintaining a national agency which the country would have liked to abolish entirely had it quite dared. In this atmosphere and under these handicaps it is to the credit of the Army and Navy that they did as well as they did. There was little money to spend on development and less still for research to produce entirely new instruments of war.

When the storm clouds of another world war began to form in the middle 1930's, the volume of articles on the place and importance of modern science in warfare increased enormously in both the scientific and lay press. So, too, did discussion of the need for insuring that scientific and technical men should be utilized in the fields of their competence and not inducted indiscriminately into the combat services where men of less specialized training could serve equally well.

So far as lay discussion was concerned, it was largely emotional, frequently ill-informed, and sometimes fantastic. Naturally, discussion among technical people was more realistic, but on the whole was mainly related to applying newly acquired knowledge and techniques to the improvement of existing military implements. The idea of organizing scientific research on a huge industrial scale, where the ultimate end of "all-out war" was the industry to be served, was slow to emerge.

Probably the most difficult hurdle every industry has had to get over in the effective introduction of scientific research as a powerful tool in its operation has been to realize that the most profitable research is that which is carried on with the least restraint imposed by current practice. Practice can be adapted to radically new ideas, but radical ideas rarely, if ever, evolve from mere improvements in current practice.

Research in military matters is no exception. War being a very ancient art, military men are on the whole extremely conservative as to new tools. Like doctors, long experience has made them cautious and with possibly a more than ordinary tendency to impose on a research project requirements of current practice which, in fact, hamper rather than help. Against this tendency is the fact that they are quick to adopt the radically new once its utility is demonstrated. War more than any other of man's activities puts a high premium on being in the lead.

As soon as war in Europe on a vast scale was seen to be imminent, the nations there commenced frantically to mobilize and organize their scientific and technical men and resources, and to establish effective liaison between them and the combat services. For more than a year after this movement was in full swing across the Atlantic, our aloofness from the struggle and our ardent desire to keep from being sucked into the tragic maelstrom operated to prevent any effective step in the direction of mobilizing our vast scientific resources for total war. The military services endeavored to strengthen their scientific branches and here and there enlisted the aid of civilian science. They were hampered by inadequate funds, by the pattern of years of a starved organization imposed by an antiwar philosophy, and by the fact that civilian sciences, both fundamental and applied, were built up on a basis of operation in a slow-moving peace economy. The latter had no machinery for marshaling its forces for war and, in the main, it knew little of war's requirements and frequently preferred to follow the courses it understood and liked.

NATIONAL ACADEMY OF SCIENCES MOBILIZES SCIENCE

But about two years ago it became apparent to a few individuals that the *laissez-faire* approach to the mobilization of science ought to be abandoned in favor of a more direct and forceful organizational approach. At that time there existed certain technical groups and associations which, on the one hand, called for strengthening, and on the other were of suggestive value in the search for a suitable organizational setup. I have already remarked upon the scattered technical groups and laboratories within the Army and Navy which over the years had been doing commendable work, but had been given insufficient funds and encouragement. It was, of course, obvious that as the tension of the emergency increased, the responsibilities placed upon these technical groups would mount with a resultant need to augment their personnel, but it was equally apparent that they could not be expected to carry the full load of scientific development and adaptation.

Civilian participation in one way or another in the solution of military problems has come to be taken for granted. It was first given official recognition in the United States when the National Academy of Sciences was incorporated in 1863 by an act of Congress. The charter of the Academy requires that whenever called upon by any department of the government, it shall investigate, examine, experiment, and report upon any subject of science or art, the actual expenses of such investigations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall

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receive no compensation whatever for any services to the government. The Academy is, therefore, recognized as a continuing official adviser to the federal government and it must attempt to answer such questions of a scientific or technical nature as are officially submitted to it by members of government departments. A permanent channel of communication was thus created, but power to initiate traffic over it resides with the government and no auxiliary machinery was created whereby the Academy or any other civilian agency might take the initiative in bringing before the government matters of scientific importance.

NATIONAL RESEARCH COUNCIL AND N.A.C.A.

Less than a year prior to the entry of the United States into the first World War, another step was taken designed to facilitate the use of the channel of communication between government and the National Academy. In 1916 the National Research Council was created by President Wilson, and a little later was to play a part in focusing civilian effort on the military problems then arising. The National Research Council was, and is today, a subsidiary of the National Academy of Sciences and, like the Academy, is largely an advisory body only and awaits the assignment of problems by one or another branch of the government before it can go seriously to work. Moreover, the Council, like the Academy, is not in possession of free money, a corporate laboratory, and other research facilities and is, therefore, not well constituted to conduct research work on any extensive scale.

We turn our attention, therefore, to another agency contemporaneous with the National Research Council, which was created for the express purpose of establishing cooperative effort between military and civilian groups, and which was provided by Congress with funds necessary to create research facilities and to operate them when once created. This agency is the National Advisory Committee for Aeronautics, commonly known as the N.A.C.A. The law which created the committee provides that it shall "supervise and direct scientific study of the problems of flight, with a view to their practical solution," and also "direct and conduct research and experiment in aeronautics." The committee is composed of fifteen members, including two representatives each of the War and Navy Departments. Throughout its more than twenty-five years of existence, the N.A.C.A. has given ample testimony of the fruitfulness of cooperation between military and civilian groups, and moreover has provided a prototype as to an organizational arrangement for effecting such cooperative effort successfully.

When, some two years ago, the group to whom I have already referred became convinced that broader participation by civilian scientists in the whole military program was likely to be essential, they regarded the N.A.C.A. as typifying the sort of organization they would like to see created. A plan was therefore drawn up envisaging a committee composed in part of civilian scientists and in part of Army and Navy representatives. On the one hand, the committee was charged with a broad study of the materials of warfare and, on the other, it would recommend and, if possible, initiate such research as they believed to be in the national interest.

The N.A.C.A. was created in 1915 by an act of Congress. The somewhat duplicative plan just referred to was submitted to President Roosevelt for such action as he saw fit to take, be it to recommend legislation or to pursue some other course. The proposal appealed to him, with the result that he decided to create the committee by executive order. This order established the committee as a division under the Office for Emergency Management and confers upon them power to take the initiative in many scientific matters which they believed to have military significance. It also directed the committee to develop broad and coordinated plans for the conduct of scientific research in the defense program, in collaboration with the War and Navy departments; to review existing scientific-research programs formulated by these departments, as well as other agencies of the government; and advise them with respect to the relationship of their proposed activities to the total research program. Moreover, and this is especially important, the order directs them to initiate and support scientific research on the mechanisms and devices of warfare with the object of improving present ones, and creating new ones.

The order contemplated that the committee would not operate in the field already assigned to N.A.C.A. nor in the advisory field of the National Academy of Sciences and National Research Council. Parenthetically it might be noted that in this latter field the Academy and Council are currently engaged on advisory work for government for which the out-of-pocket expenses alone are at the rate of much more than $1,000,000 a year.

NATIONAL RESEARCH DEFENSE COMMITTEE ORGANIZED IN 1940

Thus, in June, 1940, the National Defense Research Committee, more familiarly known as the N.D.R.C., was born. It was constituted of eight members, two of these being high-ranking men from the Army and Navy, respectively, five more being civilians well known for their experience in organizing and directing both fundamental and applied scientific research, and, as an eighth member, the Commissioner of Patents.

The Executive order creating the N.D.R.C. omitted any reference to the biological sciences, and in particular to the medical sciences. However, during its first year of operation, experience accumulated to the effect that a broader program of attack would not only be useful but was, in reality, urgently demanded. This realization prompted a second approach to President Roosevelt, with the result that in June, 1941, he created two new functional groups. One of these was the Committee on Medical Research, to explore its indicated territory in the same manner that the N.D.R.C. had been exploring the physical sciences. Then, over and above both the N.D.R.C. and the Committee on Medical Research, there was placed the Office of Scientific Research and Development, usually referred to as O.S.R.D. This latter office was placed in charge of Dr. Vannevar Bush, who until then had been chairman of the N.D.R.C. President Conant of Harvard was then made chairman of the N.D.R.C. and Dr. Richards of the Medical School of the University of Pennsylvania was made chairman of the C.M.R.

In order to insure complete coordination of civilian and military research and development, Dr. Bush, as director of O.S.R.D., was provided with an advisory council consisting of the chairmen of N.D.R.C., C.M.R., and N.A.C.A.; the coordinator of Naval research and the special assistant to the Secretary of War performing a somewhat similar function in that service.

The executive orders creating these various committees naturally had to leave indeterminate the question of financial support. They are all subsidiary to the Office for Emergency Management and, like this office, must look to Congress for the necessary operating appropriation. Thus far the appropriations, while not munificent, have been adequate. During its first year of existence the N.D.R.C. authorized research projects which totaled about ten million dollars. At the beginning of its second year it was granted another ten millions and this was recently augmented by several millions more. To be more specific, the O.S.R.D. during its first year of existence, will guide the expenditure of about twenty millions throughout the whole scientific field.

I should now like to take a few minutes of your time to explain the manner in which the expenditure of these funds is initiated and supervised. To begin with, let me point out that the work of the N.D.R.C. is divided into four major departments: Division A, of which Prof. R. C. Tolman of California Institute of Technology is chairman, deals with armor, bombs, and ordnance, in general; Prof. Roger Adams of the University of Illinois heads Division B on chemistry; Division C deals with transportation and communication, and submarine warfare, and I am its chairman; finally, Division D, which deals with instruments and numerous miscellaneous projects difficult to catalog, is headed by President Compton of Massachusetts Institute of Technology.

To expedite discussions, surveys, and the general handling of the work, a further breakdown has been found desirable, the result being that each division comprises several so-called sections. Division B on chemistry, under Professor Adams, is divided into thirty-one sections—which stands to date as a sort of record.

HOW N.D.R.C. FUNCTIONS

The work of a section is entrusted to a section chairman, who in turn calls to his aid certain individuals who become permanent members of his sectional committee and who are known technically as members. Then there are others who may be asked to render advice and assistance from time to time and hence are called consultants. Members and consultants are officially appointed by the chairman of the N.D.R.C. and are designated only after official clearance by the Army and Navy Intelligence and the F.B.I. Full consideration is therefore given to the basic requirements of the military services as regards the confidential handling of their problems.

Neither the five civilian members of the N.D.R.C. itself nor any of the section chairmen, members, or consultants are paid from public funds. Without exception, they are loaned to the government by their employing organizations and frequently the loan is complete, the work being so voluminous and detailed as to require a man's full time. Thus, when I tell you that about 500 of the leading scientists of the country are encompassed in the present N.D.R.C. organization, you will see that the federal government and even the forgotten taxpayer are getting a lot of valuable consulting talent free of charge.

So far as I have now outlined it the functioning of the N.D.R.C. requires no public money except a very small amount for paid office assistants together with the traveling expenses of members and consultants. For the most part members and consultants do not carry on the research and development projects which the N.D.R.C. decides to promote—their duties are advisory and administrative. They formulate the problems which they believe it important to have undertaken, and then arrange with various scientific institutions to carry on the work. It is this last step which brings in the need for considerable sums of money. For instance, a project assigned to a particular university may require the full time of several of its faculty together with that of numerous younger men hired specifically for the work in hand.

The number of such projects now approved and, for the most part, contracted out to universities and industrial research laboratories stands around 550 while the number of contracting institutions is over 100; and when it is stated that the total value of the projects thus far determined upon is upward of twenty million dollars, you will realize at once that the monetary resources of the scientific world would not be adequate to conduct the program on a gratuitous basis. The contracts vary all the way from those involving a few hundred dollars to those calling for two to three hundred thousand dollars per month.

The question is frequently asked as to how many technical people have been drawn into the civilian defense effort which the N.D.R.C. directs, but obviously this is quite difficult to estimate, let alone to enumerate in detail. I have already mentioned that there are about 500 scientists in the N.D.R.C. organization serving as members, consultants, etc. It seems likely that somewhere between two and three thousand scientists are at work on defense projects as employees of contractors with about an equal number of less highly skilled individuals assisting them as laboratory assistants, technicians, etc. Then, if the situation which I know to exist at the Bell Telephone Laboratories is to be taken as a criterion, we must add to this scientific group another very considerable array of technical people who call themselves engineers as opposed to physicists and chemists—an array which if enumerated would no doubt total four to five thousand.

Recent figures from the Bell Telephone Laboratories might be of interest as perhaps typifying the situation found in a number of industrial laboratories which are fulfilling defense contracts, some for the N.D.R.C. and some directly for the Army and Navy. A rough count shows that about 600 of our technical staff are now engaged directly on a full-time basis on defense projects. When I say that they are "engaged directly" on defense projects, I am excluding those who by circumstances arising out of the defense program have been forced to devote themselves to such problems as the finding of substitute materials and the engineering of emergency telephone projects.

"NO PROFIT" FEATURE OF N.D.R.C. OPERATION

Another aspect of the N.D.R.C. plan of operation which I should like to stress is its "no profit" feature. This applies alike to contractors and to employees of contractors. Perhaps this point can be brought out most clearly by reference to a specific situation. The University of California is acting as a contractor to the N.D.R.C. on a large project which involves an annual expenditure of around one million dollars. Certain members of the California faculty are employed on a full-time basis on the project and in switching from teaching to defense work have incurred no change in rates of pay. The university has also hired from other faculties certain individuals to augment the defense staff and they, likewise, have gone over without changes of salary, although a payment is made to compensate for the cost of moving in the case of both single and married men. It is also stipulated explicitly that the university, as contractor, will derive no monetary profit from the work and the same requirement is exacted of industrial laboratories and other types of contractors.

The "no-profit no-loss" proposition has involved the adoption of certain more or less arbitrary but seemingly equitable rules of accounting. Thus, a university is usually allowed an overhead payment amounting to 50 per cent of the salaries which it pays to its members employed on a defense project. Similarly, an industrial laboratory, by virtue of the fact that it has to operate with commercial capital and is subjected to a variety of forms of taxation from which the university is exempt as well as other expenses, is allowed an overhead of 100 per cent of the salary item.

I suppose it depends upon one's point of view as to whether the effort I have just outlined appears large or small. On the one hand, it seems fairly certain that it is only a beginning and must expand further. On the other hand, it is certainly large already when contrasted with any civilian effort which was able to assert itself during the last war. And looking back to the situation which existed a quarter of a century ago, it is difficult to understand why the then available civilian agencies were not unleashed to an extent commensurate with their obvious capabilities. True, the National Research Council was created to assist with the solution of defense problems, but it was, as I have pointed out, in the position of a doctor waiting for clients; it could not adopt the attitude of an aggressive salesman and initiate attacks on what it regarded to be important military problems. Hence we can declare that as regards organization notable progress has been made.

As to future expansion of our civilian defense effort, it is becoming increasingly essential to bear in mind the potential shortage of trained personnel. Without insinuating anything as to guilt, the chemists declare that this is a physicist's war. With about equal justice one might say that it is a mathematician's war. The visible supply of both physicists and mathematicians has dwindled to near the vanishing point, consistent with the maintenance of anything like adequate teaching staffs in our universities. If this civilian-defense effort is to expand, and such indeed now seems imperative, the limiting factor may therefore be a shortage of highly trained individuals and not a shortage of financial aid.

This leads me to state a few general observations concerning the past and future of our work. It is quite apparent that to date the burden of N.D.R.C. contracts bears much more heavily upon some institutions than upon others. At the outset this has necessarily been the case. While serious attention has at all times been given to the subdivision of projects so that they could be farmed out as widely as possible, a limit is frequently reached beyond which it is not practicable to go in the matter of division. In many cases, no division at all could be entertained, a situation that has given rise to a few large contractors, of which I cited the University of California as an example.

In the assignment of the early contracts it has been natural, in fact essential, to lean heavily upon those institutions, both academic and industrial, which for one reason or another have been peculiarly fitted to transfer quickly from peacetime to wartime problems. This has been done with a view to conserving time. But the stages of the program to follow will doubtless involve a broader survey of the situation to find locations where new problems can be lodged with a minimum of interference to essential defense work and teaching now in progress. In this survey a guiding principle will be to utilize men and facilities in situ whenever possible, thus preserving the "going value" of groups who are accustomed to working together. In the face of crises, the human tendency is usually to do the reverse, it being so easy for central agencies to ignore established but not well-known organizations, and attempt to cope with an emergency by calling workers from right and left to some new location. As a matter of fact, this tendency was beginning to make an appearance even as long as two years ago when the fundamental plan of the N.D.R.C. was under discussion. Had the tide then setting in been allowed to run on for some months unimpeded, the result would inevitably have been a literal army of uprooted scientists in Washington and other central points, sitting around idly waiting for vast amounts of research equipment which had been placed on order, but was not much nearer materialization than that, to be installed in hastily constructed laboratories. This would have been the easy and disastrous way. Fortunately, the creation of the N.D.R.C. came in time to stem such a tide.

Another present problem, and it is the last with which I shall trouble you, is one which by its existence supplies evidence that real progress has already been made in some of the research programs thus far initiated. It has to do with shortening the time gap between proved laboratory-research results and the stage where mass production can be undertaken. Some of the laboratory results already achieved hold such promise that every day which intervenes before their widespread utilization becomes a serious matter. Obviously the problems to be met here cover a wide range of equipment and materials—as wide as that marked out by the scientific results themselves—and since they involve large-scale manufacture, the whole plan must be carefully worked out with other official agencies, particularly the Office of Production Management. I am sure, however, that we are prepared to meet and solve these problems, and rather than be concerned with the difficulty of making progress along this avenue, I think all who are guiding the work of the N.D.R.C. would exclaim to the ranks of scientists and technicians, "Bring on your results, the more the better, and we will guarantee them a speedy passage to the firing line!"

Galloway, N. Y.

WORKING AT ENGINE LATHE ON PUMP PLUNGER

HEAVY TANK T1

DESIGNING *for* DEFENSE

By G. M. BARNES

ASSISTANT CHIEF OF INDUSTRIAL SERVICE, RESEARCH, AND ENGINEERING U. S. ARMY

IT WOULD be unnecessary for me to tell this group that it would have been impossible for the Ordnance Department to have entered the commercial field for over nine billion dollars worth of munitions unless it had been able to tell manufacturers what was wanted through the medium of detailed drawings and specifications. To my mind, there is an important story to be told as to how the rather small Ordnance organization was able to prepare itself to furnish these data promptly to manufacturers. It may be of interest to recall at this time that the total average yearly appropriation of the Chief of Ordnance prior to 1938 was approximately twelve million, and that of this sum, about one and one-quarter million dollars was available for research and development.

The Department has on its shopping list some 1700 major items and over 200,000 principal components. These items include all of the fighting equipment used by modern armies including the small shoulder rifle, the various types and calibers of machine guns, all calibers of artillery, and many kinds of ammunition, both high-explosive and armor-piercing, all sizes of bombs, bomb fuses, fire-control instruments, tanks, armored cars, and so on through the great list. The Department made the very best possible use of its limited funds over this period, prior to 1938, taking up the development of the various types of equipment item by item, year by year. In this way, a new group of ordnance equipment greatly superior in fire power and ballistic characteristics over any weapons available at the end of the World War was projected.

The quality of this development was checked through the reports received from our military attachés located in all parts of the world as to the characteristics of foreign equipment. In this way we were able to keep careful track of the trend of ordnance development abroad. Selected Ordnance officers and engineers were sent to foreign countries to visit manufacturing plants and government arsenals and to purchase as much foreign equipment as possible for test at home in comparison with American equipment.

When the emergency started, the Department had the drawings and specifications of its new matériel ready for issue to the manufacturers. Unfortunately the funds provided were only sufficient to enable the Department to make a few test models of each type of equipment. And it was therefore envisaged that difficulties would occur when this newly developed equipment was produced in large quantities by commercial manufacturing plants.

Presented at the Annual Meeting, New York, N. Y., December 1–5, 1941, of The American Society of Mechanical Engineers.

With this in mind, the Department organized over a year ago some twenty-five engineering committees. Each manufacturer was asked to name one or more engineers as members. Selected Ordnance officers and engineers having special knowledge of each type of equipment were likewise designated to attend. There was a committee on tanks, one on half-track vehicles, a committee covering the manufacture of all types of rifle-bore shell, a committee for automatic cannon, thus covering the entire field of ordnance weapons. These committees have now been meeting approximately once a month throughout the last year. The representatives of the manufacturers were encouraged to bring to the meetings their suggestions as to changes which might improve production. The cooperation which we have received from the engineers of industry in this effort has been most gratifying, and it has been pleasing to know that American manufacturers have found the ordnance drawings and specifications acceptable.

Our policy in regard to changes has been to place revisions to correct errors and minor modifications on a 24-hour basis. Major changes which might affect functioning usually have been deferred for future models. I might illustrate the government's policy by citing the case of the M3 tank, the current-production model. While the five commercial concerns which are now manufacturing this tank on a production basis were tooling, their engineers were studying our detailed drawings and specifications. These recommendations were considered carefully at the meetings of the Tank Committee and the drawings were changed to meet the requirements of mass production. In the meantime, the Department designed the medium tank M4, built a pilot, tested it at the Proving Ground, and had it tested by the using service, in this case, the Armored Force. The medium tank M4 includes many engineering improvements, the great majority of which have been suggested by the engineering representatives of the manufacturers. The medium tank M4, however, will not reach the production lines for several months in the future because it has been placed in rear of the production of the M3, and in this way will not interfere or tend to decrease the current monthly production of tanks.

The ordnance-manufacturing arsenals played a vital role in the conversion of industrial manufacturing plants into the arsenals of democracy. When the emergency started, the doors of these arsenals were thrown open to the manufacturers of ordnance equipment. Each arsenal is the technical center of knowledge for certain ordnance items or groups of items and all the technical information accumulated for many years has been made available to manufacturers. The Department's policy is not to restrict a manufacturer as to the methods, but rather to provide him with working drawings and specifications, and to permit him to see how this item or a similar item has been manufactured at an arsenal in the past. In many cases the skilled personnel at the arsenals have been able by visits at manufacturing plants to overcome difficulties. I have heard nothing but praise from manufacturers of the assistance which they have received. It is sometimes stated that the manufacturing capacity of the government arsenals is but ten per cent of the capacity required in a war effort. This figure is approximately correct but represents an understatement of the value of these arsenals in our national-defense program.

When the emergency arose it was appreciated fully that there would be greatly expanded and accelerated requirements for research and development of all ordnance items. There were dammed up within the Department a great many ideas for the improvement of ordnance equipment which were released by the arrival of adequate research and development funds.

In time of war when millions of men are using ordnance equipment and when their very lives depend upon their military characteristics, there arises a rapid evolution of all items. Already daily reports are being received from our observers abroad as to new weapons under development there and of new ideas brought from the front. It was realized by the Department that its manufacturing arsenals, which are in effect development laboratories, would be unable to keep pace with the tempo of this research program. It was therefore decided that our activities would be expanded by utilizing the personnel and facilities of industrial companies.

I could best illustrate how the development of a new item comes about by citing the case of the 4.7-in. antiaircraft gun, a new item of which you have never heard. In order to make this example clear, it would be necessary for me to review briefly the situation in regard to antiaircraft artillery in the United States at the beginning of the emergency, September, 1940, as that was the date on which the first large appropriation of two billion dollars was received for munitions. At that time we had under limited production the 3-in. antiaircraft gun, our standard

90-MM ANTIAIRCRAFT GUN M1

HALF-TRACK GUN M2 AND 105-MM HOWITZER

weapon of outststanding performance. Reports from abroad indicate that ninety per cent of the bombing over England and Germany has been carried out at altitudes not exceeding twelve thousand feet. As the 3-in. antiaircraft gun is excellent up to fifteen to eighteen thousand feet, this weapon is considered a first-class antiaircraft tool.

In September, 1940, the development of the 90-mm antiaircraft gun had just been completed and this weapon is now under quantity production. It outclasses the standard German antiaircraft 88-mm gun, in range and other military characteristics. It is a more powerful weapon than the 3-in. in that it fires effectively at higher altitudes, using a heavier and more effective projectile. However, it was foreseen that as airplanes carried their bomb loads into the stratosphere, there would be demands for a still higher-powered weapon. Consequently, studies were started in the Ordnance Office of a more powerful gun, and as a result of these studies, it was determined mathematically that the 4.7-in. caliber would represent the optimum. These studies were forwarded to the War Department and by the War Department to the President of the Coast Artillery Board, the service which mans the antiaircraft artillery in the United States Army. The Coast Artillery Board made an independent study of the subject and found itself in agreement with the recommendations made by the Department. The General Staff therefore directed the Ordnance Department to initiate the 4.7-in. development project and to build a model for trial.

The first step was to retube a larger gun to 4.7 in. caliber to meet the ballistic requirements laid down in our calculations. The ballistic laboratory at Aberdeen Proving Ground designed a new type of projectile, and a trial lot of ammunition was made at Frankford and Picatinny Arsenals. In the meantime, the Department had selected a commercial company to undertake the design and manufacture of the carriage. It might be a fair question to ask why the carriage design was turned over to a commercial manufacturer rather than the design of the gun which was made at Watervliet Arsenal. The design of a gun would require the use of about one hundred drawings while three to four thousand drawings would be required for the carriage. The design of the gun could well be made by the experienced personnel of the department but the facilities of a commercial plant were employed to augment our own in the design and manufacture of the carriage.

This commercial company working under the supervision of the Ordnance Department has completed the design and is manufacturing the carriage. In the meantime, the ammunition has been fired in the trial gun and found to correspond with the ballistic calculations. Already a number of these units, guns, carriages, and ammunition have been placed in production. The first trial of the gun, carriage, fire control, and ammunition in the completed form will take place this month.

A similar case is the heavy tank. Here again a commercial company was selected to design and manufacture the heavy tank with the assistance of the Department. The design of the heavy tank has been completed and the pilot tank successfully manufactured. Already the heavy tank has been placed in production. In this way the Department has greatly expanded its facilities and personnel for research and development.

At the present time there are some six hundred principal development projects and approximately five hundred American companies are assisting the Ordnance Department in its research and development program.

During the last year, there have been approximately one hundred forty five new items of ordnance built, tested, and standardized through the joint activities of the Department and American industry. A weapon is not standardized for the United States Army until it has been tested by the Infantry, Cavalry, Field Artillery, Coast Artillery, Armored Force, or the combat arm which uses it, and until that arm has found it tactically superior to the former weapon used, in that it fullfills some new tactical use. In view of the constantly expanded research and development activities of the Department, it is safe to conclude that a still larger number of new weapons will be perfected and placed under production during the coming calendar year.

It should be reassuring to the American people to know of ever-increasing flow of completed ordnance equipment weapons to newly formed armies. This country soon will exceed all others combined in the mass production of ordnance equipment. The government has placed its research and development programs on a broad basis, utilizing the great scientific and engineering talent available in the country to the greatest possible extent. This will insure that in this emergency our country will outdistance all others in the technical development of new fighting tools for our armies and for those armies abroad allied with us in this world effort.

INVENTION *for* DEFENSE

By L. B. LENT

NATIONAL INVENTORS' COUNCIL, WASHINGTON, D. C.

I AM sure there is no particular significance in the order in which these topics appear on this morning's program, but I submit that it all begins with invention; at least with that dictionary definition which says that invention is "mental fabrication or concoction." By this definition, every fresh idea is an invention.

Since human beings engaged in mortal combat, those with the best weapons and smartest ideas usually emerged victorious. This has been true for thousands of years. In modern warfare, it is still true.

One has but to recall a few of the significant inventions to realize that the whole art of warfare (so to speak) has been changed as the ideas for new weapons or devices emerged from men's minds and were transformed into useful realities.

The invention of gunpowder made all previous weapons impotent. Smokeless powder and rifled guns greatly enhanced the effectiveness of those who possessed them. Ericsson's invention of the armored revolving turret made all previous types of naval vessels obsolete. The submarine has certainly changed orthodox naval tactics.

In more recent times, the development of the airplane into a combat vehicle and the development of the caterpillar tread into such a terrifying monster as the modern tank have completely changed our mode of warfare.

It is not too much to say that modern warfare is largely a battle of inventive ideas. In the past, American inventive genius has been largely responsible for the development of our industries and the constant betterment of our standard of living. If turned from peaceful pursuits to the problems of national defense, it should contribute powerfully, perhaps decisively, to the success of the present efforts in the preservation of our kind of civilization.

In times of emergency, such as we now face, the number of inventions and suggestions submitted by the public for governmental use increases to such an extent that some special agency is clearly needed—an agency whose only job is to give immediate and sympathetic attention to every invention, suggestion, or idea which might have any possible value in our scheme of national defense. The National Inventors' Council was created for that purpose. It has been in active operation since about October 1, 1940. Results to date show that it is of very real value to the military services and other bureaus concerned with the national-defense program.

Its value, however, is in almost direct proportion to the number of contributions which come from the trained minds of those who comprise the membership of our technical professions—particularly the members of The American Society of Mechanical Engineers.

The National Inventors' Council has just finished a little more than a year of active operation. During that time, more than 38,000 cases were examined by the Council staff.

Of the many inventions and suggestions received, most of those found useful have come from members of the technical professions, as might be expected. Some of these may soon prove to be very potent in our scheme of national defense. It is important, therefore, that this flow of worth-while inventive ideas be not only continued, but increased if possible. For this reason, I bespeak your interest in what our Council is organized to do and to make full use of its facilities.

The Council was created late in August, 1940, by the then Secretary of Commerce, Mr. Harry Hopkins, with the full concurrence and approval of President Roosevelt. Dr. Charles F. Kettering was asked to become chairman and the Council members were selected. Mr. Conder C. Henry, now assistant commissioner of patents, then organized a service staff and the Council began active operations about October 1, 1940. Its primary purposes are:

(1) Encouraging the public to submit inventions and inventive ideas having any possible value in our plans for national defense.

(2) Prompt examination and evaluation of these inventions by a staff of engineers and by a system of technical committees, so that useful ideas may be promptly placed in the hands of the proper military branches and naval bureaus and such other agencies as might find them of potential value.

It is also thought that a central library of suggested inventions is of considerable continuing value. An obvious reason for this lies in the fact that good ideas, no matter how good, seem to require a period of rest, so to speak, before someone discovers their real value and puts them to work. Call it mental inertia or mental viscosity, if you like. But whatever its name, it seems to have delayed the adoption of many useful ideas in the past. The Council is striving to improve this situation.

The present members of the Inventors' Council, all of whom serve without pay, are as follows: Charles F. Kettering, *chairman*, Thomas Midgley, Jr., *vice-chairman*, Lawrence Langner, *secretary*, George Baekeland, Rear Admiral H. G. Bowen, Hon. Conway P. Coe, William D. Coolidge, Watson Davis, Frederick M. Feiker, Webster N. Jones, Brig. General Earle McFarland, Fin Sparre, Maj. General W. H. Tschappat, Orville Wright, and Fred Zeder.

Our technical staff is composed of seven engineers and a chief engineer. Each is a specialist in one or more fields.

To handle efficiently the work of examination and evalua-

There are many ways in which engineers can help invention for defense.

In the first place, keep in mind that inventive ideas which you may develop in connection with your own job may have some application in problems of defense.

Next, give assistance to subordinates with inventive ideas. Help them to organize their ideas and prepare their material for orderly consideration by others.

Also discuss inventive ideas of your subordinates with them. A large percentage of inventions coming to us are found useless because the inventor is not familiar with the prior art nor is he well grounded in the fundamental physics or mechanics upon which his invention is based.

Some companies have a suggestion box into which employees may drop suggestions for more efficient plant operation.

And finally, don't forget that some ideas, which may not be useful in connection with a particular device, may find a most useful application in some other field.

Address presented at the Annual Meeting, New York, N. Y., December 1–5, 1941, of The American Society of Mechanical Engineers.

tion, inventions and suggestions are considered under twelve main headings, which follow Patent Office classifications, and which have been found very convenient.

Each of the committees covering these twelve general divisions is chairmaned by a Council member or by one of the individual members of the committee. Each committee chairman may nominate his own members, who are later approved by the chairman of the Council and serve without pay, after taking the federal oath of secrecy.

These subject headings (12) are as follows:

1. Ordnance and Firearms
2. Land Transportation and Armored Vehicles
3. Aeronautics
4. Remote-Control Devices
5. Instruments
6. Naval Warfare
7. Signals and Communications
8. Chemicals and Chemical Warfare
9. Internal-Combustion Engines
10. Metals and Metallurgy
11. Forts, Fortifications, Other Structures, and Camouflage
12. Clothing, Sanitation, Health, and Commissariat.

The Council receives inventions, suggestions, and just plain ideas, by mail and through the personal calls of inventors. Many inventors seem to think their ideas are so important that no one but the President should know about them. Others send their inventions to Senators, Congressmen, Members of the Cabinet, and to ranking officers of the Army or Navy. But all are forwarded to our office for primary examination. Each invention, suggestion, or idea received is acknowledged, then classified, and referred to one or more staff engineers for careful examination and evaluation, particularly for its possible value to the national defense. Those appearing meritorious are then referred to the appropriate Technical Committee Chairman for his consideration and report. An invention thought to be of value is forwarded to the Army or Navy, or other appropriate defense agencies, for their consideration—and ultimate adoption if they find it acceptable. In such event, the appropriate department of the Army or Navy then deals directly with the inventor in making the necessary arrangements for the use of the invention. The Council itself does not consider the question of compensation or of contracts between inventors and the Army or Navy.

RELATIONS WITH THE PATENT OFFICE

Now, some who submit inventions seem to misunderstand the relations between the Council and the Patent Office. It should be mentioned here that submission of an invention to the Council does not, in itself, fully protect the inventor's rights. Those submitting inventions or inventive ideas of value are usually advised to make application for a patent, if they have not already done so. The Patent Office makes no distinction between applications submitted to it direct and those previously presented to the Council.

Submission of inventive ideas to the Council does not prejudice the inventor's interests, should he at any time desire to apply for a patent.

All material submitted to the Council is held in strict confidence.

THE KIND OF INVENTIONS FOUND USEFUL

The kind of inventions which have been found useful to one or more of the defense agencies can be classified roughly in two broad fields, namely: Improvements in present devices or present methods; and ideas which are entirely new, but which may be so promising that military requirements and strategy can be planned to utilize them.

Many of the first class have been received and a few of the latter. It might encourage you to know that a few of the devices or weapons submitted might be classed as revolutionary. They are now under development and test and may, someday soon, be heard from in tones not pleasant to the Axis powers. Obviously, the nature of these cannot be disclosed.

And it may also interest you to know that of the ideas having potential value to the armed services: About 40 per cent are in the general field of ordnance, which includes all kinds of guns and ammunition and also tanks, amphibians, and fire-control devices; about 20 per cent are in the field of aircraft, including power plants and flying equipment; and the remaining 40 per cent encompass all other phases of warfare. A relatively large number pertain to geometric and optical instruments and to radio and other electrical devices.

The number of devices and ideas which are of potential value is quite surprising and indeed most encouraging.

As you may imagine, we do have many suggestions of what are sometimes called "crackpot" variety. Such suggestions, however, receive full consideration, for in them may lie the germ of the worth-while idea. Those who submit them are obviously working in an unfamiliar field or are uninformed respecting even the fundamentals which may underlie their invention. Many such suggestions are, of course, most amusing. If time permitted, one might mention a few for entertainment purposes. However, the daily consideration of these cases brings a growing conviction of the need of a larger percentage of ideas coming from those who know their subject.

Of course, we have had "death rays," but none which have yet killed anybody. We've had several schemes for robot airplanes or projectiles which chase other airplanes, but the inventors' ideas are usually general suggestions, the details of which must be worked out by others—if the thing is to work as the inventor thinks it should. However, there is hope, at least, in this field.

And, as in the last war, we still have all kinds of plates and nets to keep torpedoes away from naval vessels, but which would slow the speed down to a walk and make the ship unmanageable in rough weather.

But, as previously intimated, don't be too surprised if something radically new and potent comes to light before this present scrap is over.

INVENTIONS BY CIVILIANS

It should be encouraging to the prospective inventor to know that many of our most useful items of military equipment have been devised and developed by civilians; in some cases by those who have had no experience in military affairs.

Well-known examples, useful in warfare, that have proved to be revolutionary are the screw propeller invented by Stevens in 1804; the revolver pistol invented by Colt in 1835; the revolving-turret warship *Monitor*, invented by Ericsson in 1861; the motor-driven airplane invented by Orville and Wilbur Wright in 1903; smokeless powder invented by Schultze in 1863; the torpedo invented by Whitehead in 1866; smokeless powder invented by Vielle in 1886; the submarine invented by Simon Lake; and the internal-combustion engine invented by Dr. Otto and developed by others.

The list might be extended to include other inventions which have had a powerful effect on modern warfare and military tactics. It should be noted here that most of our noted military inventions have come from those outside the military services.

Many of these revolutionary inventions were rejected by the military authorities when first submitted. Ericsson's *Monitor* failed at first trial because it did not meet speed requirements and was not fitted with sails. However, don't let this deter you from submitting your invention, for both the Army and Navy are now keen to utilize any helpful suggestion. Peacetime lethargy has been swept aside by the dictator's ruthless march.

You may well ask—what kind of inventions do you want? Many who write to us do.

It's not always easy to answer this question. If we were to tell in detail just what is wanted, it would disclose what we lack. And such information may be just as valuable to an enemy as knowing what we have—at least, so say the War and Navy Departments.

However, it's hardly necessary to say that any kind of inventions may be found useful in our national-defense scheme. One thinks first of those which have direct application in warfare.

Such inventions are, of course, of prime importance and of much interest to the military authorities. Entirely new conceptions may be found sufficiently potent as to justify a change in present strategy and tactics. But present military requirements must usually be met.

Many inventions received by us have been found useful in expediting some part of our vast production program. Others have to do with the substitution of some more common material for materials which are now on the critical list. For example, many think of substituting plastics for metals, but the materials for making some plastics are now getting scarce. So we are now seeking substitutes for yesterday's substitutes.

I mention these things to show how complex is the field in which new ideas may find application.

KIND OF INVENTIONS WANTED

But to get back to cases. It would seem almost obvious that the birth of such an invention as may be classed as revolutionary must be preceded by the incubation of an entirely new and unknown conception. In other words, we may have to invent the problem and then find the solution.

For example, away back in 1620, Cornelius Van Drebel, a Dutchman living in England, had the idea that an underwater boat would be a fine thing and he built one propelled by oars—so it is claimed. During the Revolutionary War, David Bushnell had the same idea and also built a man-powered submarine, with which Sergeant Ezra Lee of the Continental Army attempted to destroy a British ship anchored in New York Harbor. Finally Simon Lake again picked up this idea and worked out the engineering problems to produce the prototype of our modern deadly power-driven submarine.

Thus the brain storm of the Dutchman in 1620 finally became a reality. He invented the problem; others worked out the solution.

Many have written to tell us that we should have some method of making ships immune from torpedo attack, but the real problem is how to do it. Again we have several suggestions that a proper application of the so-called "electric eye"—the photoelectric cell—would permit us to steer aerial bombs and many other forms of projectiles, but again the method of doing it is the real problem and may involve several inventions.

There are still many possibilities in increasing the effectiveness of airplane attack and, of course, the defense against it.

The detection and precise location of submarines and defense against submarine attack is a field in which invention may find ample use and adequate reward.

Time does not permit mention of any but the few examples just mentioned. Most of the inventions received by us are essentially improvements in what we now have. But many have already proved their value.

And so the field in which useful defense inventions may lie is just about limitless.

And so we come finally to the question: How can the engineers, the members of this Society, help?

There are so many ways in which engineers can help that only a few may be mentioned.

HOW ENGINEERS CAN HELP

In the first place, keep in mind that inventive ideas which you may develop in connection with your own job may have some application in problems of defense. Examples of this are innumerable. A method of rolling steel tubes, now in wide use, has recently been found applicable in the rolling of liners for big gun barrels. An automatic control system for use in a factory may be applied to remotely control the aiming and firing of guns. And so it goes.

Next, give assistance to subordinates with inventive ideas. Help them to organize their ideas and prepare their material for orderly consideration by others. Don't forget that it was a woman who planted in the inventive mind of a young tutor named Eli Whitney the idea that a machine was needed to remove cottonseed from the fiber. You never can tell where some worth-while idea may come from.

Also, discuss inventive ideas of your subordinates with them. A large percentage of inventions coming to us are found useless because the inventor is not familiar with the prior art nor is he well grounded in the fundamental physics or mechanics upon which his invention is based.

For example, many inventors think of sound waves or light waves as a prime medium for energizing a projectile for chasing airplanes—"bloodhound projectiles" we call them. But they forget that airplanes now race through the air at about half the speed of sound. By the time the sound from airplane engines reaches the sound detector, the airplane may be two or more miles away from where it was when the sound left it.

Neither visible light waves nor infrared rays penetrate fog or dense haze; so that source of detection is not so good. Radio waves seem to be most promising as an element in remote-control devices.

So let your younger associate have the benefit of your more experienced knowledge, if a worth-while idea is being hatched.

Some companies have a suggestion box into which employees may drop suggestions for more efficient plant operation. It might prove helpful if another question box be added into which employees might put inventive ideas which they think would be of assistance in the national defense.

And finally, don't forget that some ideas, which may not be useful in connection with a particular device, may find a most useful application in some other field. Examples of this are numerous. One, very much in our minds at present, is that the same jet reaction which some have proposed for propelling rockets may find useful application as an added force in assisting airplane take-off from landing fields of small area or where runway facilities are inadequate.

The Chicago Section of your Society has recently circulated a most commendable bulletin—a message concerning National Defense from the Defense Inventions Committee. In it, the privileges and, indeed, the duties of the mechanical engineer are described in a manner which should challenge the attention and interest of all who may read it.

If the entire membership of A.S.M.E. could receive this message, it should have most gratifying results.

It would seem to be the privilege and indeed the patriotic duty of the inventive minds of our country to transmit the results of their creative thought to that government agency charged with the duty of making them useful in this time of national emergency—The National Inventors' Council.

EDUCATION *for* DEFENSE

By A. A. POTTER

DEAN OF THE SCHOOLS OF ENGINEERING, PURDUE UNIVERSITY, AND EXPERT CONSULTANT, U. S. OFFICE OF EDUCATION

MODERN mechanized warfare is a test of the relative strength of the scientific, engineering, and manufacturing skills of nations. New techniques, materials, and machines have to be developed, designed, constructed, and adapted to serve military, naval, and civilian objectives. Failures abroad in the present conflict have been traced to a lack of recognition on the part of the once great nations of the importance in modern warfare of skilled mechanics and of engineers.

Early in the spring of 1940 it became apparent that our national-defense effort will require for its effectiveness millions of skilled workers as well as large numbers of engineers competent in a wide variety of technical services. It was felt that trade schools, vocational schools, and engineering colleges, which represent a large investment of public funds, should be utilized in training skilled workers and in meeting the shortage of engineering and supervisory talent.

VOCATIONAL TRAINING

Vocational Training. On June 27, 1940 (Public 668), Congress made available to the U. S. Office of Education $15,000,000 for a summer defense program of "less than college grade," which involved courses of the vocational type for which high-school graduation is not a prerequisite and which do not conform to college standards. This was followed by additional appropriations of $26,000,000 on October 9, 1940 (Public 812), and $52,400,000 on July 1, 1941 (Public 146). The "less-than-college-grade program" also received $28,000,000 for equipment, $25,000,000 for training of out-of-school youth (rural and nonrural) and $17,500,000 for vocational training of N.Y.A. enrollees. This makes a total appropriation up to date for the "less-than-college-grade" vocational training program of $163,900,000. This expenditure, through the U. S. Office of Education, has benefited industry through special training courses to more than a million people up to August 31, 1941. Enrollments during the present year are expected to reach more than one and one-half million in pre-employment and through in-service training courses.

The enrollments in the "less-than-college-grade" vocational program have resulted during 1940–1941 in in-service training to about 12 per cent of the untrained employed and in pre-employment training to about 14 per cent of the workers added during that year. During the present year it is expected that this program will benefit about 16 per cent of the employed workers and about 30 per cent of those to be added to industry.

COLLEGE-LEVEL TRAINING

Training on the College Level. Those in contact with the program for defense expenditures were convinced about one and one-half years ago that there is bound to be a great shortage of engineering and supervisory personnel. Even if we had not set out upon a gigantic armament program, it is reasonable to conclude that after more than a decade of depression our country would be entering at this time upon a period of productive activity which would require for its effectiveness large numbers of engineers, scientists, and production supervisors. As it is we are now faced with the problem of developing in a very short time, in addition to peacetime requirements, a defense production capacity which must surpass that accumulated by Germany during a period of about eight years. General Charles P. Summerall, former Chief of Staff of the U. S. Army, in a recent article in the *Military Engineer* stated that "The change in the tempo and magnitude of military operations is the direct result of military equipment that engineers have put into the hands of soldiers. . . . Without superlative good engineering in the national war effort there will be no military victories." To an increasing extent production of equipment needed in national defense was being accomplished by the dilution and overloading of key engineering and management staffs of our industries. As more and more contracts were awarded to defense industries the shortage of engineering and supervisory personnel became very acute.

The output of engineering colleges, which was barely sufficient to meet normal peacetime needs of industry, was falling very short in satisfying growing needs of defense industries and of the armed forces of government. While suggestions have been made to accelerate the regular engineering programs of study, this plan was found to be undesirable at this time, as it was felt that a speed-up would seriously lower the effectiveness of the engineering educational process, would interfere with the research programs of value to national defense, and would involve additional costs to colleges without appreciably increasing the output of engineers from these institutions, as many college students must earn during the summer in order to continue in school. Significant additions to the normal number of engineering-college graduates cannot be made quickly, but the defense need is immediate. Production of defense material cannot wait.

E.D.T. PROGRAM

Engineering Defense Training Program (E.D.T.). In recognition of the existing and impending shortage of engineers Congress appropriated on October 9, 1940 (Public 812), to the U. S. Office of Education nine million dollars for the purpose of preparing people quickly, through intensive practical courses on the engineering-school level, for specialized tasks in fields essential to national defense. As of June 30, 1941, a total of 2354 such courses were in operation or had been completed at 144 engineering schools to 107,700 enrollees. Of these, 16,200, or 15 per cent, were in full-time preservice intensive short courses and 91,500, or 85 per cent, were in-service courses for those now employed. One engineering school, which enrolled during this program 2086 unemployed, reported that at the end of the training period all but 111 were placed in defense employment. The same engineering school reported promotions to new and greater responsibilities of 1145 of those who were enrolled in in-service courses.

E.S.M.D.T. PROGRAM

Engineering, Science, and Management Defense Training (E.S.M.D.T.). Reports regarding the Engineering Defense Training program from defense industries, the Army, and Navy have indicated that this program has been most helpful in meeting a need for technical and supervisory talent by supplementing the output of engineering colleges and by upgrading the ex-

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Address presented at the Annual Meeting, New York, N. Y., Dec. 1–5, 1941, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

panding technical and supervisory staffs so that they are able to assume greater responsibilities. In the spring of 1941 there was not only a shortage of engineers, but defense industries and government were hard-pressed for supervisory personnel as well as for physicists and chemists. Accordingly, an additional appropriation of $17,500,000 was made to the U. S. Office of Education on July 1, 1941 (Public 146), "for the cost of short courses of college grade provided by degree-granting colleges and universities . . . designed to meet the shortage of engineers, chemists, physicists, and production supervisors in fields essential to national defense."

On November 15, 1941, preliminary proposals were approved by the U. S. Office of Education under the new E.S.M.D.T. appropriation for the training of nearly 190,000 people in 2520 different short courses offered by 149 colleges and universities. It is expected that provisions will have to be made to take care during the present fiscal year of about 400,000 enrollments in short courses of collegiate grade for engineers, industrial supervisors, chemists, and physicists.

INTENSIVE COURSES FOR SPECIALIZED TASKS

Appraisal of Defense Training on College Level. It is recognized that fully trained engineers, scientists, or industrial supervisors cannot be produced through short courses in a period of a few months. It is possible, however, to utilize intensive courses in preparing people for specialized technical tasks, to retrain for new specialties and to impart to engineers special knowledge of value in connection with supervisory responsibilities. The engineering, science, and management defense-training program is not intended as a substitute for a regular engineering-college curriculum leading to a degree. Its main objective is to aid in meeting the urgent need for technical and supervisory staffs in the rapidly expanding defense industries and government by utilizing the facilities and experience of engineering colleges in a specialized training program on the engineering-school level, while maintaining at these institutions effective undergraduate and graduate full-time programs leading to engineering degrees and encouraging greater activity in research of special value to our armed forces and to our defense industries.

Subjects taught vary from elementary courses in engineering drawing and materials inspection to advanced courses in ultra-high-frequency radio technique, airplane-engine design, and physical metallurgy.

About 85 per cent of those enrolled in defense classes are employed people who are devoting about two evenings per week to studies intended to prepare them for greater responsibilities in connection with the defense program. This upgrading and promotion of engineers to more important posts open opportunities for less trained people.

An important feature of the E.D.T. program, which is being continued under the E.S.M.D.T. program, was the provision of specialized technical training for officers and civilian employees of the Army and Navy. Under the E.D.T. program 106 intensive courses were given in 24 engineering colleges exclusively or largely for officers or civilian employees of our armed forces. These included such courses as Diesel engines, aeronautical engineering, explosives, inspectors of ordnance materials, and marine engineering. Under the E.S.M.D.T. program 19 additional courses for the Army and Navy personnel have already been approved at 13 different colleges and universities.

In an effort to secure a detached and unbiased evaluation of the college-grade defense-training program, the Training Within Industry branch of the Office of Production Management secured for the U. S. Office of Education, through its panel members, reports from industrial executives regarding the program carried on by the colleges and universities. These reports, with rare exceptions, were most favorable. One company reported 25 per cent increase in output as a result of the training program, and most companies felt that the short courses have been particularly valuable in training the expanding supervisory staffs and in preparing engineers for new tasks. The Secretaries of the Army and Navy state that the program has enabled the armed forces to qualify quickly for technical duty large numbers of newly commissioned officers.

The colleges and universities are benefiting by this defense-training plan on the college level, in that they are able to continue their regular programs, are not forced to develop courses on the trade and vocational-school level, as was the case in connection with the S.A.T.C. during the first World War, and are in a position to bring their teachers in close contact with defense industries. This closer relationship between industry and the teachers of our colleges and universities is bound to react beneficially to higher education and will be one of the valuable by-products of the present emergency.

PROBLEMS AHEAD

Problems Ahead in Defense Training. It has been estimated that about 3,000,000 more defense workers will be employed during the next year and that by the middle of the calendar year 1943 defense employment will reach at least 9,000,000. The National Resources Planning Board in its pamphlet "After Defense—What?" issued in August, 1941, estimates $11^3/_4$ millions in defense industries during 1942 and $15^1/_2$ millions in 1943. It has also been reported that direct military construction may increase from $3^1/_2$ billion dollars in July, 1941, to about $6^1/_2$ billion dollars in July, 1942, and may reach as high as 8 billion dollars in 1943. About one million or a third of the new workers will have to receive some form of pre-employment training and about $1^1/_2$ million or a fifth of the untrained employed workers in 1942-1943 should be afforded some in-service training. Thus, the less than college grade program during the fiscal year 1942-1943 will involve special training to at least $2^1/_2$ million people.

Notwithstanding the large numbers which have been trained through the E.D.T. and the present large enrollments in the E.S.M.D.T. program, the shortage of engineers, scientists, and particularly production supervisors is bound to be very serious for a long time ahead. Persons completing full-time short courses on the college level are quickly absorbed, and there is an urgent demand by industries for part-time in-service courses to qualify persons already employed to assume new or increased responsibilities. More and more of the large industries are translating their defense orders in terms of work to be accomplished and the practice of farming out defense orders is growing.

A 28-ton tank built by one manufacturer is reported to represent materials, supplies, and finished goods bought directly from 700 individual companies located in 130 cities in 20 states. Much supervisory and engineering effort is necessary to keep production moving in many small shops, which ordinarily have inadequate engineering and supervisory personnel. The only hope of supplying large numbers of engineering, scientific, and supervisory personnel needed for our rapidly expanding defense effort appears to be through the expansion of defense training on the college level. It is expected that at least one-half million course enrollments on the college level will have to be provided for in plans for the fiscal year 1942-1943.

Apparently, the most serious need at the present time is for industrial production personnel on the higher levels. To develop an adequate and effective program for the training of such supervisory personnel will require the closest cooperation between industry, the engineering colleges, and the colleges of business.

CONSERVATION *and* RECLAMATION *of* MATERIALS

UNDER the auspices of the Committee on Conservation and Reclamation of Materials in Industry a session on this subject was conducted in connection with the 1941 A.S.M.E. Annual Meeting on Tuesday, December 2.

The program of the first portion of the session consisted of the presentation of the four actual "case histories" here published.

After these papers had been delivered, Harvey N. Davis, who presided at this session, introduced a "panel of experts" headed by Philip D. Reed, chairman of the board, of the General Electric Company, who acted as interlocutor for the Clinic that followed. Questions had been solicited by mail in advance of the meeting and these were edited and sent to members of the panel so that well-studied answers were prepared in advance. Mr. Reed, after a few comments on the importance of the subject and the value of the session, read the prepared questions, the answers to which were then given by the members of the panel addressed.

The "panel of experts" was made up of the following: F. J. Allen, product engineer, York Ice Machinery Corp., York, Pa.; W. L. H. Doyle, research engineer, Caterpillar Tractor Co., Peoria, Ill.; W. F. Drysdale, director general of industrial planning and engineering, Department of Munitions and Supplies, Canadian Government, Ottawa; W. W. Finlay, manager, Cincinnati Division, Wright Aeronautical Corporation, Cincinnati, Ohio; D. R. Kellogg, assistant to manager, engineering laboratories and standards, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.; John C. Parker, vice-president, Consolidated Edison Company of New York, Inc., New York, N. Y.; C. E. Smith, vice-president, N.Y.,N.H.&H.R.R. Co., New Haven, Conn.; and W. A. Straw, superintendent of development, Western Electric Co., Inc., Hawthorne, Ill.

It is probable that the questions and answers which constituted the Clinic will be published in a later issue of MECHANICAL ENGINEERING. In the meantime, additional questions are being received and the Committee is considering the next steps to be taken to make best use of the material so far developed and to assist in the important work of giving publicity to the need for conservation and reclamation of materials used in industry and practical suggestions on how to accomplish these desired objectives.

The personnel of the Committee on Conservation and Reclamation of Materials in Industry that planned and conducted the session was as follows: Robert M. Gates, chairman, president, Air Preheater Corporation; Howard Coonley, chairman of the board, Walworth Company; Harvey N. Davis, president, Stevens Institute of Technology; L. C. Morrow, editor, *Factory Management and Maintenance;* George F. Nordenholt, editor, *Product Engineering;* and Roy V. Wright, vice-president, Simmons-Boardman Publishing Company.—EDITOR.

CASE I—*Reclaiming and Using Scrap Materials*

By W. W. FINLAY

WRIGHT AERONAUTICAL CORPORATION, CINCINNATI, OHIO

IN VIEW of the size of the subject and the limitation of time available for its discussion, it is proposed to deal only with waste and used materials that are the direct result of manufacturing processes.

In presenting such an outline as this, covering in rather broad terms the methods employed at the Cincinnati plant of the Wright Aeronautical Corporation of handling the reclamation and disposal of materials incidental to our manufacturing processes, it is necessary that certain data regarding the factory be remembered.

This factory is a single-story building housing a machine shop, materials, and tool-handling and storage facilities, an assembly shop, and the equipment for testing high-powered aircraft engines, which happen to be the product of the factory. This one building covers 40 acres of floor space and contains, in addition to heat-treating, washing, plating, painting, and similar facilities, over 2000 machine tools varying from small single-spindle machines to a multiple-station Greenlee, which is 65 ft long. There are several buildings supplemental to the main building, chief among which is a large aluminum foundry designed and equipped for the single-purpose job of casting aluminum-alloy cylinder heads.

The manufacturing processes, so far as is practical, are laid out in continuous operation lines; that is to say, the machines in any given line are set up on a single-purpose basis for the production of that particular part. Obviously, there are a few variations from this, where the machine loading for the required operation is low and the operation set-up change is fairly simple.

In the planning of such a factory a very important consideration is the handling of

Machine lubricating oils
Cutting oils and coolants
Washing solvents
Degreasing fluid (trichloroethylene)
Honing compounds and grinding coolants
Engine lubricating oil.

In addition, there is the obvious problem of handling large quantities of cuttings and chips with segregation of the materials for eventual use or disposal in the pure form, so far as is practical. That is to say, if the quantities justify, the cuttings from a particular alloy should be kept separated from other cuttings of a somewhat similar material. In this entire reclamation program there are two main considerations:

1 The economical and efficient operation of the factory.

2 The conservation of materials under our present war economy.

To give some idea of the size of the problem, provision has been made for purifying: 150 barrels of cutting oil per day; 90 barrels of washing solvents (for cleaning engine parts); 115 barrels of engine oil (that has been used for engine testing); 10 drums of trichloroethylene; and in addition, lesser amounts of honing compounds, grinder coolants, hydraulic oils, spindle oils, etc.

To illustrate the size of the chip-handling problem, one high-production item, the air-cooled cylinder barrel of nitralloy steel weighs approximately 62 lb as received in the rough state, and when completely machined, weighs 17 lb. This means that 45 lb per barrel has been removed in chips, or when multiplied by the required production, represents approximately 18 tons per day. For every cylinder barrel there is a cylinder head which is of cast aluminum alloy made in the foundry at Cincinnati, already referred to, which in turn produces its quota of chips by the ton.

This problem falls into two main parts: (1) Reclamation, and (2) disposal.

RECLAMATION

The oil used in the machines as a coolant in most cases is a mineral oil containing lard or saponifiable oil, with some variations in the viscosity of this oil, depending upon the type of operation.

A standard type of collecting pan has been designed and installed to fit practically all the various types of machines into which the chips and turnings from the maching operation either fall directly or are raked by the operator. An electric truck designed for this particular job lifts the pans from the floor and dumps the contents into side-dump trailers that are brought down the aisles between the machines, wherever possible at the back of the machine and not in the main traffic aisle. When filled, these dump trailers are accumulated on a concrete platform immediately outside the main machine shop into trains of from 6 to 10, and then drawn by tractors to the oil and chip house at the rear of the plant.

Here, it would be advisable to mention this oil and chip house which has been built to perform the function implied by its name, that is to say, to handle the major part of the job of receiving, reclaiming, and shipping for re-use or disposal all of the items previously enumerated. There is one obvious exception to this which will be touched upon later.

Upon arrival at this oil and chip house, the cuttings are crushed by swing-hammer pulverizers. The chips so crushed are handled by a continuous pan-type conveyer to a charger hopper, and from the hopper, centrifugal-separator baskets are filled and carried by overhead monorail to the extractor, where all of the oil is extracted centrifugally.

The chips are then discharged from these baskets into a delivery conveyer which carries them to a vertical elevator which discharges into either of two 100-ton hoppers above the railroad siding. A gondola car can be filled in fifteen minutes by gravity from these hoppers.

The oil as it is extracted from the chips is accumulated in sumps at each extractor, where the heaviest metallic and dirt particles settle by gravity. From here it is pumped to a larger tank where the oil is heated and sterilized by passing steam through coils within the tank and from here fed by gravity through a centrifugal extractor where most of the remaining dirt is removed. From this extractor it is pumped to a filter tank where final cleaning is accomplished by filtering through a tightly woven fabric called moleskin and from there by gravity to a clean-oil accumulating tank. From this point in the oil and chip house the completely reclaimed oil is pumped through underground pipes to the central distributing station in the machine shop for redistribution to the machines.

Experience has taught that it is most desirable to change the cooling oils in machines regularly and the oil in the tank and pan of the machine is pumped by an electrically driven pump into a 550-gal tank truck that is drawn around about the shop in much the same fashion as the dump trucks previously described. When the tank truck is filled, it is taken to the nearest of several locations where the dirty oil is discharged into pipe lines carrying it into the oil and chip house. When there, it is treated exactly as the oil extracted from the chips previously discussed.

Washing solvent, which is a Stoddard solvent, is used in spray booths or tanks for cleaning parts and at each one of these booths or tanks there is a small sump tank into which the solvent drains by gravity. In these tanks are small centrifugal pumps forcing the used solvent through overhead pipes leading into a main line that carries the used liquid to the oil house. From accumulation tanks in the oil house it is pumped to gravity tanks which feed vacuum steam-heated stills. After condensation, the reclaimed solvent is pumped to clean tanks from which it is delivered back to the shop pipe lines, under pressure, ready for re-use.

The engine oil used for the lubricating of engines on test is a high-grade paraffin-base oil delivered from the refineries under rigid specifications. The fact that approximately 6000 gal of this oil will be used daily indicates the size of the job.

Careful investigation and research showed that the only way this oil could be successfully reclaimed was by a complete re-refining process whereby the product from the re-refiners will be equal to the new oil. The equipment finally installed simulates the original oil-refining process.

Oil drained from the engine is carried by gravity lines from the test cells to an accumulation tank in the basement of the oil house. From there it is pumped to the refining equipment where it is mixed with a diatomaceous earth. The oil is then subjected to high heat and high vacuum in retorts and the resultant is then treated with filter-aid and neutralizer. After this it is forced through a filter press using heavy paper liners. The oil so obtained is absolutely clean, and after having an addition agent mixed (a content of the oil included at the refinery but which is lost in the distillation process) is now ready for use and is accumulated in clean tanks from where it is pumped back to the test cells for use in the engines.

The trichloroethylene taken from the grease is not handled by pipe lines but drummed at the point of usage and then taken by trailers to the oil house where, by vacuum distillation, it is cleaned and redrummed ready for redistribution to the machine shop.

Honing compounds and grinding coolants are purified right at the various machines and in the machine shop. This is accomplished by portable equipment of the centrifugal type mounted on a truck. This truck, which is a very neat piece of equipment, is pulled alongside the machine. The dirty compound is pumped into a centrifuge that discharges the clean liquid into the tank attached to the portable equipment. When the machine base is pumped out, it is wiped clean and the tank of the machine refilled with the purified liquid.

The one exception to large-scale reclamation not handled in the chip house is the obvious one of remelting gates and risers and scrap castings in the foundry. This scrap material is transported by overhead conveyer to a remelting room where it is discharged into one of two remelting furnaces and, after the molten metal has been thoroughly skimmed of dross and other impurities, it flows by gravity into the ingot molds that are attached to a continuous belt conveyer that discharges the solid ingots at the point where the belt starts its return journey. After check by the laboratory for chemical analysis, the ingots become part of materials inventory for mixing with virgin alloy.

DISPOSAL

The disposal problem is largely one of intelligent segregation. Where the quantities are sufficiently large, the particular alloy is segregated and accumulated and disposed in bulk. Where segregation is not practical, then similar materials will be disposed of in a mixed form. This factory is not equipped to remelt any of the turnings and cuttings incidental to the machining processes and after reclaiming the oil as described, they are disposed of to reputable scrap dealers. Close supervision and coordination is necessary to insure proper handling, both as to actual disposal in the interests of conservation for National Defense under the regulatory requirements of the O.P.M. and price under federal price control. In addition to the disposal of aluminum, which the factory is not equipped to reclaim, there is brass, copper, magnesium, and steel mostly in chip form but also in sweepings and in the case of aluminum, dross from skimmings. There is also, as in all machine shops, some scrap in the form of spoiled parts, and these parts are mutilated to prevent improper use and then disposed of through the same channels, segregated as to the alloy. In addition to this, there are such things as nickel-iron melting pots, burlap bags, wooden barrels and kegs, steel drums, and large metal cans which are also disposed of through reputable scrap dealers.

This job of conservation and reclamation is based largely upon an accumulation of past experience, to which has been added the experience of others and the help of the suppliers of equipment for such a program. The approach to and devising of the foregoing methods of reclamation and disposal have been conditioned and modified by:

(*a*) A desire for economy of operation through direct savings and the indirect but highly important advantage through neatness and cleanliness of the factory.

(*b*) The necessity for the conservation of strategic materials and man power in an intensified defense economy, by salvaging for re-use within the factory and segregation for most economical use after disposal.

(*c*) A knowledge that the manufacture of high-powered aircraft engines is a dynamic business involving constant change both as to design and manufacturing methods, and therefore, whatever is done in factory planning and layout must in no way impede the technological progress of the product. In the last analysis, the object is to build the finest in airplane power plants and the reclamation of materials, while very important, must definitely take second place.

CASE II—*Examples of Conservation and Reclamation*

BY W. L. H. DOYLE

CATERPILLAR TRACTOR COMPANY, PEORIA, ILL.

OVER fifty employees at "Caterpillar" with a department of their own, are effectively "panning pay dirt" from factory waste—discarded materials, tools, and numerous other commodities. Many of these men are specialists, who, prior to a few years ago, worked in production, tool design, metal stampings, shipping, and other operating departments.

A certain portion of the salvaged material, after suitable classification, is sold. The remainder is reclaimed by various means and used to replace otherwise newly purchased items and materials. Decisions as to employment of any reclaimed tools or materials in all cases rest on the one important principle that such uses shall in no way cause any change in the standard quality of the product.

The economical functioning of the reclamation department results from the excellent cooperation of the individual foreman and various machine operators throughout the plant. This is the outcome of considerable educational work which has been done through the medium of numerous biweekly divisional foreman conferences. By this means the entire organization, through these keymen, is familiarized from time to time with any new routine procedures required to fit in with any new developments in the reclamation undertaking. This cooperation is important and greatly aids in the proper segregation of various materials.

At present mild-steel turnings are collected by chip wheelers and conveyer-loaded into freight cars. "Hair," or thin-gage croppings, and miscellaneous scrap are delivered from various points throughout the plant by a narrow-gage industrial railway system to a section in the storage yard, and from here loaded into freight cars by a magnetic yard-crane hoist. Under present conditions, more than 42 carloads of this material are loaded monthly. Next to this section is piled all of the heavy melting steel scrap. This includes all sorts of mild steel of $^1/_8$ in. section and larger and is stored ready for foundry orders, having been reduced to cupola size by means of an alligator shear or the cutting torch. From this stock an average of 17 carloads per month are delivered to the foundry division.

All nickel-steel turnings are delivered by the chip wheelers to a section where, after chemical spot-check test, it is baled in form suitable for cupola charging. Nickel bar ends, scrapped nickel-steel parts, and scrapped nickel-alloy cast-iron parts are accumulated in the yard bins, and from this source an average of five carloads of this material per month, regularly finds its way to the foundry cupola.

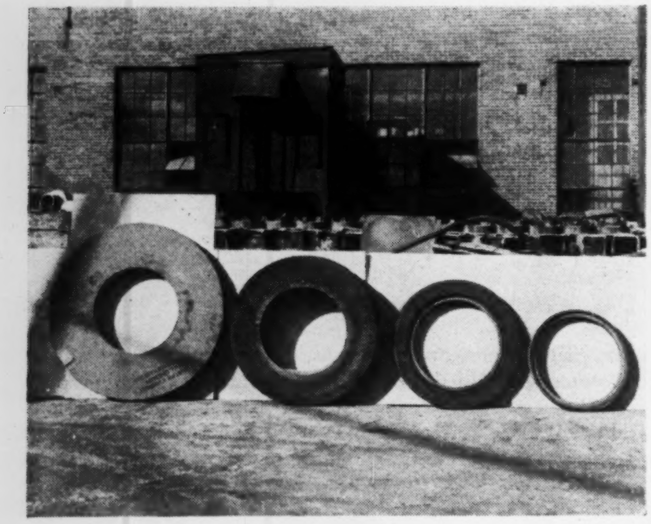
All iron borings are collected in containers and transported by lift trucks and the narrow-gage system to a briquetting machine, which, under present conditions, produces for use in the foundry cupola upward of 33 tons of briquettes per day.

In a matter of months a separate building will have been completed in which will be housed new briquetting machines and auxiliary equipment required to handle the mild-steel cuttings and nickel-steel cuttings, and for an increase in output of the existing iron-borings briquetting capacity. Use of this equipment for such conditioning will greatly augment the supply of scrapped material for the foundry division. In fact it is expected that output from this plant extension will just about supply the scrap material requirements of the foundry division, based on current requirements.

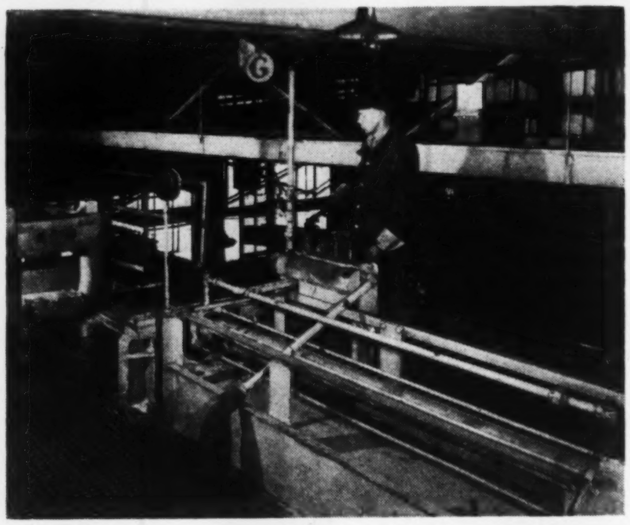
A very workable procedure is followed in reclamation of

MILD-STEEL TURNINGS ARE LOADED INTO FREIGHT CARS

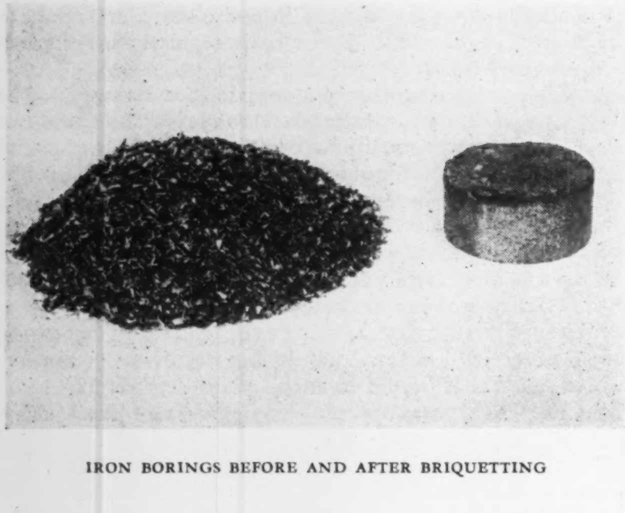
NICKEL-STEEL TURNINGS ARE GIVEN CHEMICAL SPOT-CHECK TEST



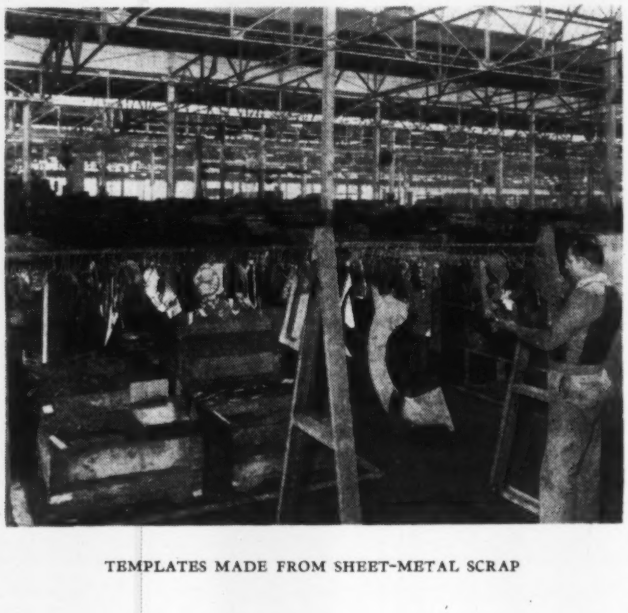
USABLE LIFE OF GRINDING WHEELS HAS BEEN INCREASED FOUR TIMES



IRON BORINGS ARE BRIQUETTED IN THIS MACHINE

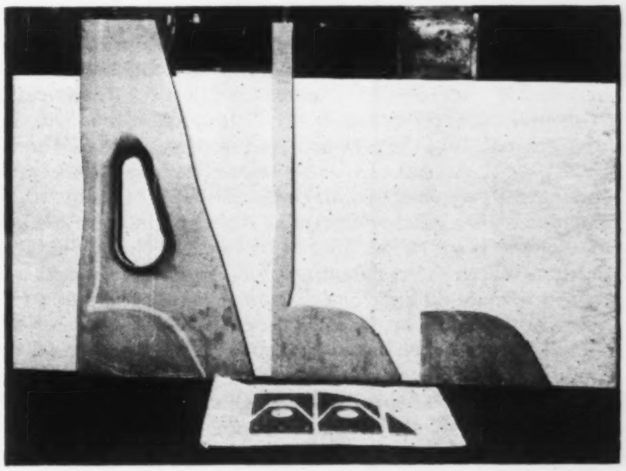


IRON BORINGS BEFORE AND AFTER BRIQUETTING

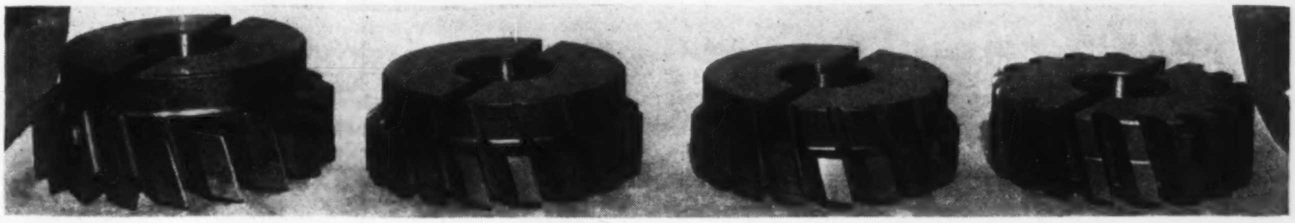


TEMPLATES MADE FROM SHEET-METAL SCRAP

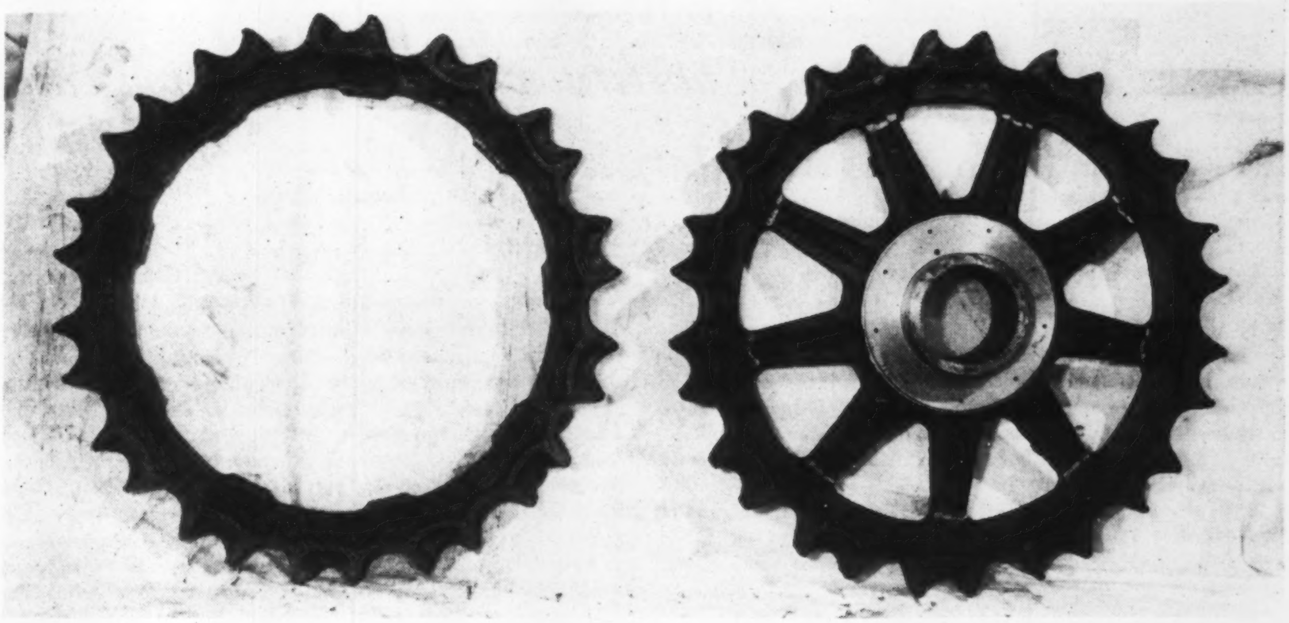
CHIPS ARE BALED FOR CUPOLA CHARGING



TEMPLATES ARE MADE FROM SCRAP METAL



CHANGES IN CUTTER DESIGN HAVE EXTENDED USEFUL LIFE



A REPLACEMENT SPROCKET CAN BE WELDED TO THE STILL SERVICEABLE HUB

scrapped tool-steel materials, parts from discarded fixtures, and other such sources. Since time will not permit outlining the processes used for such salvaging, suffice it to say that among the rest an appreciable monthly poundage of this material is salvaged to be sold as specially segregated tool-steel scrap to producers of high-speed tool steels.

As results of good collaboration in the various production departments and, based in part on observations of tool parts as elivered to scrap, some worth-while changes have been evolved, for instance in cutter designs, which have resulted in extension of usable life of these parts by as many as five and six times previous normal life. In another case, this collaboration has resulted in the extension of the usable life of grinding wheels, in case of certain types, to four times previous normal life.

A prolific source of materials conservation is in the re-use of small pieces of sheet-metal croppings and slugs. Knowing the source from which it comes, the department operators segregate this material into given material specification classifications, after which, the miscellaneous pieces are cropped to regular sizes and stored in an orderly manner. As a result of experience in this work, a large number of templates of currently usable stampings have been accumulated. The foreman of this division receives notice of all production schedules involving materials of the type he has in storage, checks his stock of existing plate sections and material specifications, and, knowing the part designation, size, and shape, as indicated by the template, can quickly determine if the reclamation stock is suitable, and if so, the number of pieces that can be produced from it. Where the reclamation stock is suitable a notice is sent to the material control department listing the number of pieces available, and at the same time, that particular stock of material is earmarked for use against the specific schedule. Handled in this manner, the reclaimed stock considerably reduces the tonnage of sheet steel which would otherwise have to be purchased. Frequently, the material control department finds it easier to use reclamation stock because it is available in small enough sections to be sent directly into the machine, whereas, sheet or strip stock, purchased new in these cases, would have to be sheared into unit sizes before going into the press.

Last year upward of 1100 different parts, totaling over a million and one-half pieces, were made from materials handled as described; it is estimated that this year the number of different parts will be well over 1500 and the number of pieces well over two million.

Various parts involved in servicing of the product have been studied with the object of enabling users in the field to reclaim some of their worn parts, thus placing such users in a position where they can helpfully alleviate a part of the defense overload. One example involves a standard drive sprocket made from a mild-steel casting. It has been found where the rim sections are badly worn that under the present conditions it pays to cut it off from the normally uninjured hub section and by means of special welding rod, weld on a newly cast special replacement rim section. Many users thus have had made available a method for reconditioning a worn part in the field. At the same time the factory production facilities otherwise required in making such parts now are conserved to a degree for current defense needs and an outlet has been found for use of rim sections salvaged when any drive sprockets are rejected to scrap.

An interesting evidence of the possibilities for cooperation between various companies in the use of reclamation materials, particularly for the benefit of nondefense industries, is evidenced in one case where our reclamation department has been supplying a sizable neighboring manufacturer with strip-metal crop ends, heretofore used as scrap. This started in the recent past at a crucial time when our neighbor would have had to shut down and lay off numerous non-defense-productive operators, due to inability to obtain needed stock from normal sources of supply. An appreciable tonnage of this material has been released to this manufacturer in this manner over a period of time, thus scrap material to one company has been a worthwhile source of supply to another and it is fair to assume that an appreciable amount of non-defense-workers' income has thus been saved from more or less complete disruption.

Reclamation developments along these general lines abound with great possibilities as between neighboring industries—and—this "panning of pay dirt" from factory waste offers very tangible reward, in the conservation of strategic materials and production facilities; as well as in operating economies for the manufacturer, who carefully follows a common-sense materials-reclamation procedure.

CASE III—*Redesign, Substitution, Simplification, and Standardization*

By DAVID R. KELLOGG

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY

IN VIEW of the diversity of our efforts and the enormous number of substitutions which have been necessary, there is a possibility and in fact a danger of talking far, far into the night. To obviate this, the chairman has been asked to see that this is terminated at a reasonable time, and, if he functions in his usual efficient manner, this speaker will not talk you to death.

While our East Pittsburgh works are very largely devoted to defense orders, this is not true of all of our outlying plants and it may be of interest to glance hastily at what some of our other plants are doing to relieve the situation caused by shortages of essential materials. Obviously, in this short period of time allowed, it will not be possible to do more than touch one or two outstanding cases at each of several plants.

REFRIGERATOR PARTS

At our East Springfield plant, where we make refrigerators and motored domestic appliances, one of the difficulties has been met by changing the brass evaporator for our refrigerators over to vitreous-enameled steel. This was the way we made our evaporators when we started in the business and we had considerable difficulty in the shop because of cracking of the enamel. This was because we had not then learned the necessity for extra-strong reinforcement and somewhat heavier sheets. We do not anticipate a large amount of trouble from this cause and, of course, most of whatever trouble does come will show up on shop test. At this plant, before these shortages occurred, as a matter of good engineering, some of our parts were redesigned to make use of copper brazing. Instead of the fan-cooled radiator, which was quite satisfactory in its performance in the earlier model, we went a couple of years ago to a radiator which consisted simply of a long steel tube copper-brazed to a pan which fitted in the back of the refrigerator and got its cooling by convection. In addition to this, certain other parts such as the muffler and the strainer which had previously been made of brass with silver-soldered connections, have been converted to steel stampings copper-brazed together. We are very thankful now that this was done because, not only does it save vital material, but perhaps more important still, it saves many man-hours; and man-hours are as much a scarcity as material. Our high-grade fans were designed a few years ago on the basis of a zinc-base die casting for the base as well as for the frame. This was a very carefully planned development with all precautions taken for spectroscopic analysis of the die castings as made. This has been abandoned to the extent that the bases which constitute by far the greater mass of material in the fan, aside, of course, from the actual motor itself, are now made from cast iron with appropriate treatment and organic finishes.

RANGES AND CABINETS

At our Mansfield plant, where ranges, cooking devices, and the refrigerator cabinets are made, we have been doing some substitution work of rather general interest. Obviously, we have had to decrease the number of cabinets because the amount of steel is limited, but those which have been made are being equipped with hardware of either cast brass instead of the aluminum die casting or in the case of those parts which have no function other than to occupy space and give a pleasing appearance, as for instance, escutcheon plates and hinge caps, we are going to the lead-antimony alloys. Thermoplastics are being used in some places instead of anodized aluminum and while these are not too easy to get, the difficulty is not as serious as in the case of the phenolics. The heater tubes for our Corox heating units have been made from a special stainless steel containing silicon, and when this became a critical material, studies were undertaken to provide a different material which would not come under this classification. After a great deal of searching it was found that one of the high-chrome steels could be used, but this involved a great deal of development work at the factory to learn just the proper schedule for swaging. These difficulties have now been overcome and we feel that this element will give quite satisfactory service. Possible shortage of this material may force the adoption of a plain steel tube, cast in iron, or even, if worst comes to worst, an open wire ceramic heater. On one of our thermostats which operated at a relatively high temperature, it was necessary to make one of the current-carrying parts from something which would not oxidize at this high temperature and would have a reasonable conductivity. Stainless steel has been used for this with perfect success but as the supplies of this material went lower and lower, it finally became impossible to obtain even the small amount needed for this piece. The engineers at Mansfield had already planned on using silver for this piece and it is now being used with success and, strange as it may seem, with not an unduly high increase in cost.

Our new fully automatic washing machine, the Laundromat, had been very carefully designed around the best materials available from the standpoint of corrosion resistance and over-all performance. This naturally meant a great many aluminum-base die castings as well as some zinc-base die castings which, running under oil in an enclosed space, could be expected to give a long life with freedom from corrosion. All these have been given up by redesign and, while the cost of manufacture is going to be rather seriously affected, I can honestly recommend to my friends the purchase of one of these machines secure in the knowledge that while their manufacture has been a rather painful thing, their use will still be as good and pleasant as if they had been made with the originally designed material.

Ice-cube trays, which were anodized rubber, with a special coating to prevent ice adhesion, are now rubber, with wire-inserted handles and stiffeners to permit putting a tray full of water into the freezing space without spilling. The economizer well on the range is now vitreous-enameled steel instead of aluminum.

CHANGES AT CLEVELAND PLANT

At our Lighting Division in Cleveland it has been necessary to abandon the use of the Alzac-treated aluminum reflectors for nondefense work. This process is still being employed on defense jobs as it produces results which cannot be obtained in any other way. Certain of the commercial lines have been modified by dropping units from them and others have been changed over to spun steel with a vitreous enamel. Silvered-glass reflectors will be used in some places and these, while they have the disadvantage of high cost and fragility, do have very good reflecting properties. Certain of the pole-line hardware employed by this division has been changed over from galvanized finish to rust-inhibiting primer and paint and we feel that while this is not as satisfactory as the galvanized job, it is at least an honest well-known finish which will fail in a gradual manner and will advertise the beginning of failure so that repainting may be done before corrosion becomes serious.

SUBSTITUTION AT OTHER PLANTS

At our lamp works in Bloomfield, experiments are being carried out to utilize a drawn-steel shell for the screw base of our lamps; this shell to be plated with brass. The nickel support wires will be replaced by nickel-plated steel in some cases and in others where the mechanical shock is not so severe, copper will probably be used.

At our Bryant Electric plant in Bridgeport we have had to abandon molding our urea-resin dishes because they have no excuse for existence in these times of scarcity. We are still using some of the thermoplastics on nondefense work as well as thermosetting resins for more critical applications. There is a little heater incorporated in our Sentinel breakers and this heater has always been anchored by two little pieces of nickel wire not more than $^3/_{16}$ in. long and about the size of the lead in a pencil. This is not a very large tonnage of nickel but the scarcity has hit us there and we have redesigned to employ spot welding. This will probably give us a somewhat better job than we had before and it is hoped the cost will be a little less.

At our meter works in Newark, the outstanding economy from the standpoint of quantity of critical material is in connection with our sockets for the outdoor watthour meter. These were originally aluminum die castings and were all that the heart of man could desire both from the standpoint of performance and of manufacturing ease. The very large quantities of these made it imperative that we get away from them as soon as possible and we have now gone to a drawn-steel shell zinc-plated, bonderized by our improved method, and then given an organic finish. This, we feel, will give reasonably satisfactory service although we are certain that it will not be as good over a long period of time as the aluminum-base die casting. It again is one of the things which can be seen and the failure of the finish will be a gradual process which can be attended to by repainting as required.

At our East Pittsburgh plant, nearly all of our chrome-nickel steel has been or is being replaced by chrome molybdenum. The tungsten high-speed steel is partially replaced by carbon-molybdenum steel, which, while not as good as the tungsten steel, still gives fairly satisfactory service on simple single-edge tools. It is not adaptable to blanking dies, so for these, a high-chromium carbon steel is being used. This warps rather badly, so it is necessary to make our dies for stator and rotor punchings out of many small pieces, hardened, assembled, and then ground to final shape and size. This greatly increases the cost, but provides a die that does the work.

The ten-minute time limit plus a warning note from the chairman prevents further dwelling on the many changes which have been made and the substitutions and redesigns which have been employed, but there is in my mind no doubt that while many of these will increase quite considerably our costs and while those which deal with finishes will give a somewhat less acceptable result, that the over-all performance of all of the equipment with which I am familiar will still be satisfactory. There is this ray of sunshine that some of these changes will probably in fact almost certainly represent improvements which will continue after the present emergency has passed.

CASE IV—*Material Substitutions*

By FRANK J. ALLEN

PRODUCT ENGINEER, YORK ICE MACHINERY CORPORATION, YORK, PA.

THERE is no doubt that the restricted supply of various materials has upset many preconceived ideas held prior to the present crisis.

Like that of other corporations, our list of changes and substitutions is already formidable, and is steadily growing. One of the first restrictions to strike us was the shortage of nickel. This affected our corporation very seriously, since most of the cast-iron parts used in our Freon compressor were made from a 2 per cent nickel cast iron.

A program was at once begun whereby the actual need in service for an alloy iron for each individual part was studied, and at the same time, experimental work was started in the development of a substitute alloy iron. For a short time the parts having the most severe service were continued being made from the curtailed supply of nickel cast iron, while the remainder of the parts were made from molybdenum cast iron. Finally, we had developed a copper-molybdenum cast iron which fully replaces the original nickel iron.

The foundry cost of the new copper-molybdenum iron is practically the same as that of the nickel iron. Such features as strength, pressure tightness, and machinability have been satisfactorily reproduced in the new iron. Naturally, both foundry and machine-shop methods required adjustment to the new alloy.

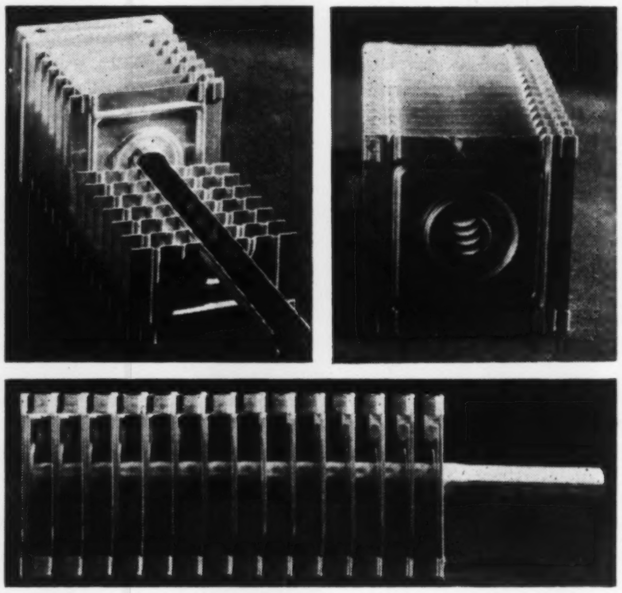
Another instance connected with the nickel shortage which affected us, was in the use of chrome-nickel stainless-steel sheets. Here we had to effect replacement with the straight chrome types. In one case where we used the 18-8 steel for its deep-drawing qualities, we are experimenting with a chrome-manganese analysis. Later the chromium was placed on the restricted list, so that at the moment this activity may not be much help to us.

However, the very first restriction to trouble us was in aluminum. Castings and forgings in this metal had to be replaced with either alloy cast iron or malleable iron.

An interesting case of the progression of substitutions is a type of finned coil which we make for refrigeration applications. This coil consisted of aluminum fins on a tinned copper tube. The finished coil assembly is not made to any standard sizes, but in each case, to the detailed measurements of the location into which it is to be fitted.

The square fins were formed from strip aluminum and automatically assembled in any one of three pitches by being held together with aluminum corner strips. (This can be seen from the illustration.) Into this assembly of fins we inserted the copper tubing, and after the coil was formed to the required dimensions, the fins were fastened to the tubing by expanding the tubing with fluid pressure.

When supplies of aluminum strip became exhausted, a change was made to tinned copper strip. In order to keep the weight of the coil from being excessive, it was necessary to reduce the thickness of the fin. However, the heat-transfer value was not adversely affected. Just as in the case of the aluminum construction, the temper of the corner strip which holds the fin assembly as a unit was the most important feature to be worked out. This strip is fed rapidly through an assembly machine which, working from four separate reels, forms this corner strip tightly around each corner of the individual fin.



DETAILS OF FINNED REFRIGERATION COIL FOR WHICH MATERIAL SUBSTITUTIONS WERE MADE

As the situation on copper supplies began to tighten, our corporation determined to assist national effort to conserve this critical material, and among other things, it was decided to see what could be done with this coil.

After some development work we produced fin assemblies made of both zinc-coated steel strips and plain uncoated steel strip. These steel fin assemblies are made on the same forming and assembling machine as were used for the copper and the aluminum. A change in the fin gage was necessary to help control the weight factor. In the case of the steel, however, additional operations are needed after the fin assembly has been made. The original selection of aluminum for the coil fins was based on its light weight, corrosion resistance, and good appearance. The tinned copper filled these last two requirements as it was received. However, for steel these features must be added to the material. After the fin assembly is made, either in the coated or uncoated steel, it is processed by being bonderized. It then receives a dip coat of zinc-chromate primer, followed by two coats of corrosion-resistant lacquer.

The lacquered-steel fin assembly is then used to form the coil on the tinned copper tubing in the usual manner.

As though to prove that nothing is quite free from change these days, it may be mentioned that we are now testing a substitute for the chlorinated rubber lacquer originally adopted for this job owing to the restriction on chlorinated rubbers.

Now that the use of copper has been so definitely and seriously curtailed under the recent Copper Order, this steel-copper type will be used as standard. While the use of this coil in food preservation will allow us under the present copper order to continue restricted manufacture, we are going ahead with still further work, looking to the manufacture of an all-steel coil.

Like other manufacturers our energies today are mostly bent on how to make the best job with those materials available, and we are sharing in the mutual astonishment of all industry on how fairly well we are doing and how much we are learning.

MECHANICAL ENGINEERS *in the* TRANSPORTATION EMERGENCY

I—By C. D. YOUNG

VICE-PRESIDENT, PENNSYLVANIA RAILROAD, IN CHARGE OF REAL ESTATE, PURCHASES, AND INSURANCES

YOUR Committee has asked me to open the discussion before the Railroad Division on how the mechanical engineer can help solve some of the problems that result from the present national emergency. It is my understanding that whatever I may have to say is from the viewpoint of the railroad man who must maintain the property and have sufficient plant capacity to render adequate rail service to satisfy requirements of the government's defense needs so that there may not be a local or general bottleneck or shortage in any of the forms of transportation.

Mr. Dickerman, I believe, is to introduce the subject from the viewpoint of those who furnish supplies to the railway industry.

Undoubtedly you will have some splendid discussions of the details of more subjects than I am charged with reviewing, therefore, my approach to this rather large order must necessarily be confined to a skeleton outline.

My remarks deal almost entirely with the old adage which admonishes us to cut our suit according to the cloth at hand.

You are probably all aware of the opinion generally held by the average layman that the mind of the engineer is almost completely inflexible. As an engineer myself, possibly I have been guilty of some uncomplimentary thoughts about the seeming inability or at least reluctance of the fraternity as a whole to change with changing economic conditions.

While wholeheartedly favoring adherence to standards which have been adopted as the result of years of experience and research, I want to emphasize the fact that a national emergency compels us to use a generous amount of common sense and ingenuity in the way we apply the results of the work of this division and of other engineering societies.

To make clearer what I have to say, I would like to introduce my talk by referring to the viewpoint of the Army, and perhaps of all the armed forces, as to the duties of the mechanical engineer, or of engineers in general, in the national emergency, and particularly in the state of near-war now existing.

Although other branches of the armed service, such as the Ordnance, the Signal, and Medical Corps, deal with mechanical-engineering problems, the brunt of the engineering work of the railway mechanical engineer lies with the Army engineers.

The first action a military man must take when he is to speak is to find the background for his subject in the "Training Regulations and the Army Manuals." Some interesting excerpts from this literature are helpful, to illustrate:

> The guiding thought of a military engineer engaged in road or bridge work would be that expediency is the rule and standard civilian practice the exception.
>
> Permanent construction beyond apparent needs is not sought, although a fair degree of permanency is often attained through the necessity of making the work strong enough to bear military loads and durable enough to keep maintenance within reasonable limits.

And, again, under Construction in War, this is what the military "bible" says:

> Construction duties place on engineer officers the heavy responsibility (as well as the disagreeable duty, at times) of limiting the use of materials to the bare necessities in order to economize, not only on the materials themselves, but also on the transportation needed to haul them.

Then, as to the engineer's personal requirements, in the "Basic Field Manual" as late as July 6, 1941, I find:

> Every effort should be made to increase interest by the employment of training expedients.
>
> The success of Engineer missions will often depend upon your own engineering skill, knowledge, initiative, and resourcefulness.

When I attended a military training lecture some years ago the instructor, in crystallizing these Regulations and Manuals, illustrated in a practical way what was meant, by citing an instance which, in the Civil War, was considered a great engineering feat. It was necessary for a Cavalry unit to cross a deep, fairly narrow, fast running stream, and having none of the usual materials on the site for the crossing—the location being in the Mid-South—they improvised from the growing grapevines on the forest trees a suspension bridge sufficient to make possible the river crossing.

I think that a fine illustration of getting along with what you have at hand, and it also required engineering skill, knowledge, initiative, and resourcefulness to see the value of the available materials, thus solving a military situation which to the enemy seemed impossible of accomplishment.

Now let us see how we can apply that principle to the subject we have in hand I epitomize my thoughts on this without elaboration.

Production of materials needed in railway work naturally follows the processes of engineering. Conferences, regarding the larger aspects of the work, result in design of details, permitting the ordering of materials and placing the project in construction or production. To expedite the work after a project has been authorized it is essential that long-drawn-out arguments leading up to engineering decisions be eliminated and the person responsible for starting production should require that all engineering controversies be settled quickly, eliminating protracted arguments. The engineer responsible for the task should make prompt decisions and then abide by them.

It seems strange to me that those from the outside who observe the railroad industry, its operations, and requirements, appear to make a fetish of standardization particularly of equipment and now that we are in a national emergency, and on the verge of war, urge that we should cut a pattern of standards and blindly follow it. It is claimed that this will speed up production, and increase the efficiency of production, and a lot of theoretical reasons are given why this would be true.

As a matter of fact, the number of designs of freight cars has been reduced to a very few by the action of the Car Construction Division of the Association of American Railroads. A considerable number are now being produced and that number will be augmented under the common designs. On the

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Contributed by the Railroad Division and presented at the Annual Meeting, New York, N. Y., Dec. 1–5, 1941, of The American Society of Mechanical Engineers.

other hand, I do not believe that this theory, when applied to steam road locomotives, is as practical and sound on account of the varying conditions of topography and restrictive clearances on the different railroads in the different sections of the country; and it is, therefore, not entirely practical to use the same sizes or weights of locomotives on all railroads without interfering with efficiency of operation.

However, I believe that during the national emergency, the practice heretofore followed by many railroads of purchasing small lots of steam locomotives to individual designs should be discontinued. There now exist a sufficient number of varying designs of steam locomotives recently built which should meet all requirements. Not only should no new designs be started during the period of the emergency but small locomotive orders should be consolidated into larger lots of a single existent design which would make speedier and more economical production. We could thus avoid new dies, fixtures, patterns, etc., as well as the time that would be consumed in engineering man-hours for each particular new design.

The full responsibility for railroad service should rest with the railroads, together with the passengers and shippers. They are in much better position to say what is needed in a given situation than those who would fix a standard pattern for all conditions and all locations, regardless of the local railroad problem. I ask you how could we use such a pattern for the United States as a whole and, as it now appears probable, for railroad service even beyond the confines of the United States? And I say all of this with a background of experience, having been trained on a railroad that probably has gone farther in the standardization of its equipment than any other railroad in the United States or in any country of the world.

The supply department of a railroad is in close touch with the problems of the industries to which it looks for materials and supplies. At the present time, the supply departments of the railroads are experiencing difficulties in securing planned schedules for their equipment and maintenance needs. In recent months, on the railroad with which I am associated, in order to meet output schedules and the programs of maintenance, we have made substitutions, practically none of which could have been accomplished without the initiative and resourcefulness of practical engineers in charge of the work; who by applying their knowledge to the available materials and supplies, made possible the use of articles differing from those called for in the design. Articles were made usable by skillful workmanship, and by the substitution of material of one quality for one of another quality, for example:

The substitution of cast iron for steel in specific cases
The substitution of plain carbon steel for copper-bearing steel
The substitution within proper limitations of Bessemer for open-hearth steel
The acquisition of surplus steel ingots made for a foreign government (but not exported) and arranging for the rolling of them into car plates.

The engineering organization has in addition substituted economical and efficient construction wherever necessary, which has met the situation in a fairly practical way. One of the leading items in this category is welding in substitution for riveting.

In passenger-car work we have found it necessary to make substitutions in trimming and interior fittings because of the scarcity of certain materials and finishes and as a result of our experience with those substitutions I am quite confident they may become permanent when the present emergency has passed; I have in mind, particularly, plastics. Intensive research work is necessary under these conditions in order that the engineer may have the proper background to determine in his own mind how far he may go in changing his practice as to materials and design to obtain the equivalent essential to the service. Research at this time should be continuously looking forward to that day when time and labor may be saved in plant improvement, and by plant I mean all of the physical facilities, that there may be a cushion sometime in the future when the present war activity of construction and manufacture has suddenly been cut off. If this work is intelligently done now, it will pay dividends in the future.

In June, 1933, I addressed your Society at Chicago where the Railway Division was having its World's Fair meeting. The subject at that time was "Research" and it was there pointed out in some detail the broad engineering problems which were being studied continuously by committees made up of representatives from all the railroads, under the direction of the Association of American Railroads. This work is still in progress and many improvements benefiting rail transportation have had their origin in these agencies and were later developed by them. One of the results of those activities has made possible, by reason of the work of the Car Construction Committee, the adoption of standard box, mill, hopper, and flatcars, already referred to. This committee working with the manufacturers of cars, specialties, and appurtenances has produced a minimum number of standard types of rolling stock which from a practical standpoint puts the builders in a position which makes for the most economical production and simplifies tremendously the problem of the steel supplier—a most appropriate action during this emergency.

The contemplated Bureau of Industrial Conservation, to be set up within the O.P.M., appears to provide an effective agency for promoting the use of substitutes, the salvaging of discarded material, and the better utilization of available resources. This group might well attack obsolete and uneconomical municipal codes and regulations to the advantage and assistance of the suppliers of material in procurement in this national emergency.

No more useful service can be rendered by engineers and engineering societies during the critical period we are facing than by re-examining our practices and designs and simplifying them to the limit, consistent with safety. It is conceivable that the difference between success and failure in this emergency might lie in the way the engineers of this country are able to reduce our industrial practices to a more rational basis. If we are the most resourceful nation on earth, as we like to believe, it is now our opportunity to prove that assertion and to prove it with a margin of safety that will leave no doubt in the public mind.

I trust that these sketchy remarks may give to those who are here, and to those who may read them a few suggestions for making the change in mental attitude which the mechanical engineers of today must make if we are to meet successfully the tremendous demands placed upon the engineering fraternity. Many of us are prone to live and work with the textbook of today, whereas in this emergency we should be writing a textbook for tomorrow.

There is, as you know, a stormy gulf between the complacent procedure of peacetime operations and the powerful drive against time which war thrusts upon us—a gulf which is not crossed without discipline and skill. With the conditions under which we are now living, most of our former objectives must be forgotten—in fact so completely forgotten that no pressure from any class or group will make us hesitate in taking up the new line of work, meeting frankly and courageously the mental and physical confusion which inevitably follows a change of this magnitude, and then turning that confusion into orderly efforts along new lines.

This change is much like that made by our pioneering ancestors. They abandoned the comforts of civilized communities to cross an ocean of uncertainty and land in a territory of experiment where it was not a question of finding any of the luxuries of home but of forcing out of nature a bare existence with the crude tools at hand.

The changes will affect the different industries in varying degree. It is probable that they will be least violent for the utilities, communications, and rail and highway transportation. For those industries, the change will be chiefly in providing for increased volume of business. For most of the others, it will mean both increased volume and violent changes in type of products. For practically all, it will mean new organization problems.

The correct solution of any problem depends upon a true understanding of what the problem really is. In this case, it must be understood correctly by a large number of people—in fact all industry must have a common understanding of the things we are working for.

With the ability that exists in this honorable body of engineers, I have no doubt but that the change will be made successfully and that the demands upon us will be met with credit to the organization.

II—By WILLIAM C. DICKERMAN

CHAIRMAN OF THE BOARD, AMERICAN LOCOMOTIVE COMPANY

I HAVE been asked to discuss here, from the point of view of the railway-equipment builder, the question, "How can mechanical engineering assist in meeting the growing transportation emergency?" It seems to me that before we can consider this question intelligently we must first, as good engineers, attempt to find out exactly what the problem is.

At the outset I must warn you that I am going to bore you, because I am going to stick to facts, and facts and figures are difficult to listen to. But war is a serious and exacting business, and I have been asked to define a problem of wartime emergency. I hope, under the circumstances, that you will forgive me for not trying to be entertaining.

As we all know, highways, coastwise shipping, canals, pipelines, and airplanes today play an important part in our transportation system. In fact, the rapid expansion of these forms of transportation during the last twenty years provides one of the principal differences between the present emergency and that during the last war.

However, the railroads normally carry two thirds of this nation's revenue freight traffic, and today they are also shouldering some part of the load previously carried by coastwise ships.

I am therefore limiting my talk to the problems facing the railroads, with particular emphasis upon the equipment-manufacturing problem.

Until now, I have never had the opportunity to put the cart before the horse on purpose. But that is what I propose to do today, with your indulgence. As everyone knows, there is little need for a cart horse unless there is a cart for him to pull, and little need for the cart unless there is something to put into it. And so I have divided my analysis of the railroad problem during the coming year into three parts. The first deals with the anticipated freight load to be hauled; the second with estimated freight cars required to carry this load; and the third deals with the locomotives required to haul the cars.

Our first consideration, then, is the load to be hauled under changing wartime conditions. And in order to determine this, we must attempt a prophecy of the future on the basis of past experience.

It has been found that carloadings bear a measurable relationship to the volume of industrial production and national income. Various experts in both government and private agencies have made estimates of national income and industrial production for the full year of 1941 and for 1942. And as might be expected, there is something of a difference of opinion in them.

However, after a careful study of the estimates, we believe that the index of industrial production may approximate 156 for the full year of 1941, and average in the vicinity of 175 in 1942. This would represent an increase of 12 per cent in 1942 over the average for 1941.

National income in 1941 is estimated to be 19 per cent above 1940, and in 1942 it is expected to increase 17 per cent over 1941. Part of the estimated increase for 1942 is based on an anticipated increase in the general price level. An estimate of 1942 national income, in terms of 1941 prices—showing a gain of 7 per cent—may not be too far off.

Now let us examine the carloading picture with these estimates in mind. It seems indicated that total carloadings in 1941 will be about 42 to 43 million, or about 16 to 18 per cent above the 1940 total. And in 1942, the total would be between 46 and 47 million, roughly 10 per cent above the 1941 figure.

Our second task is to estimate the number of cars we have or are going to need to carry this load. Remember, it will be in 1941 a load 16 per cent to 18 per cent greater than in 1940, and in 1942 it will be 10 per cent greater than in 1941.

In July of 1940 Mr. Ralph Budd tried to foresee the railroads' hauling capacity.

As a result, carriers adopted a program to increase total freight ownership from 1,646,000 cars on July first of that year to 1,700,000 by October 1, 1941. Due almost entirely to a shortage of materials, principally steel, this program fell short of the goal by about 24,000 cars.

With the increase in the defense program, and the adoption by this country of the Lend-Lease bill, a new proposal was made early in 1941 to increase freight-car ownership to 1,800,000 by October 1, 1942.

This new proposal calls for an addition of 100,000 new cars over the goal previously set for 1941 ownership. On top of this, the shortage of 24,000 cars in the 1941 program must be made up, and an additional 30,000 cars must be added to take care of the estimated retirements of cars during the coming year. In other words, we face the fact that a total of 154,000 new cars is required to meet the October 1, 1942, goal.

Now I want you to consider for just a moment what that schedule means in terms of raw materials—not to mention what it means in terms of the production capacity of car builders. Here are the requirements of materials for 154,000 freight cars:

Plates	827,750 tons
Shapes	654,500 tons
Sheets	223,300 tons
Bars	84,700 tons
Forgings (including axles)	327,250 tons
Steel wheels (one half)	207,900 tons
Cast-iron wheels (one half)	231,000 tons
Steel castings	554,400 tons
All other materials	277,200 tons

This list totals up to 3,388,000 tons of material, including

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about 554,000 tons of steel castings alone. In view of the great need for steel castings in connection with the manufacture of ordnance, finding and allocating this requirement is going to be a real job.

Assuming that this fundamental problem of materials can be solved, this means that during the coming year there must be an average installation into service of about 12,800 cars per month.

During the first ten months of 1941, the average number of cars installed monthly was about 6500. In October, it was nearly 9000. Now, if the October rate, which is the highest to date, is not stepped up during the remaining eleven months, we may expect a shortage of at least 45,000 cars in the programed ownership of 1,800,000 cars on October 1, 1942.

And if the average is no better during the next eleven months than it has been during the first ten months of this year, then we may expect the program to fall short of the goal by 75,000 cars.

In looking at the program for the coming year, we should bear in mind that comparatively more new cars will be required than last year, because a substantial part of the increase in serviceable cars last year resulted from the repair of unserviceable cars. In some quarters, it is held that 4 per cent is an irreducible minimum percentage of unserviceable cars, and during 1941 we have almost reached this limit. I am convinced that we cannot expect repairs of unserviceable cars to come to the rescue of the new car-building program in the year ahead as was the case this last year.

But there is another factor in this situation which we cannot afford to ignore. As all of you know, the efficiency with which cars are used is sometimes as important as the number of cars we have. All of us are familiar with the great steps the railroads and shippers have taken during the last year to increase operating efficiency.

The efficiency of use of freight cars may be measured in terms of the number of active cars required to move one carload weekly. This measure is also frequently expressed in terms of the days required to complete the entire transportation service, from one loading to the next. This is designated as "turnaround" time.

Measured in this way, the efficiency of use summarizes the efficiency of all operations involved in moving freight: (1) The time required in loading and unloading; (2) the distance over which loads are hauled; (3) the speed of freight-car movement; (4) the time required for transfers between interconnections; (5) switching and terminal operations; and (6) time required in making the empty haul to the next carload. Freight-car utilization has fluctuated substantially, although over a period of years there has been an underlying betterment, principally for technological reasons. In addition, utilization varies seasonally, being somewhat lower in the winter than in the summer and fall.

Let me pause for a moment and ask you to keep two sets of figures in your minds. We have estimated load to be carried as 16 to 18 per cent higher in 1941, and 10 per cent higher in 1942 than in 1941. If production schedules can meet the program which has been laid out, we hope to have on hand by October 1, 1942, 1,800,000 cars to carry this load. And I want to remind you again that there is very grave doubt that all of those cars will be available. The way we are going now it is more than likely that we will be short about 75,000 cars on October 1, 1942.

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This brings us to the third part of our investigation, which deals with locomotives. We have seen the extent and probable rate of the freight burden facing us for the next twelve months. How does it affect the locomotive industry?

It is extremely difficult to use an over-all ratio between the number of freight cars to be hauled and the number of locomotives to haul them. Freight cars are more nearly standard in their designs and can be used almost equally as well in one part of the country as another. Locomotives, on the other hand, are to a large extent custom-made, and they are usually bought for use under one specified set of conditions. We *can* say, however, that the defense program, with its increased freight-hauling burden, has greatly accelerated both the locomotive requirements and the number recently produced. Exact definitions of future requirements for additional locomotives must be correlated with the individual requirements of the various carriers.

The effect of the defense program on the locomotive industry has been an acceleration, not only of the number of locomotives built, but a broadening of the industry's structure to include other defense projects. Our locomotive plants are now turning out tanks, gun carriages, and other articles of ordnance and defense. This extra burden is a factor which must be borne in mind when any projected plan of locomotive building is discussed.

Total October shipments of 104 units, including exports, from manufacturers and railway shops were higher than any month this year. On November 1 of this year, the total backlog of locomotives ordered and undelivered, including railway shops, was 985 units. Of these, 311 were domestic steam locomotives, of which 267 were on order with manufacturers. Under present manufacturing conditions, this represents a substantial part of available shop capacity.

On November 1 of 1940, unfilled orders totaled 295 locomotives, of which 137 were domestic steam locomotives, including 125 on order with manufacturers. And foreign orders this November totaled 77, compared with 26 last November.

The number of locomotives available for service increased from 35,243 on November 1, 1940, to 37,530 on November 1, 1941, which represents a gain of 2287 units. During the same period, locomotives actually in service increased 2803 units, going from 33,126 last year to 35,929 on November 1 of this year.

Unless there is a better opportunity to build new locomotives in volume, then the major opportunity for further increasing the effective locomotive supply will have to lie in repairing the unserviceable units, and in more effectively using the currently available serviceable equipment. The chief difficulty in building locomotives in volume lies not alone in the shop capacity of the locomotive builders. But it lies in the necessary diversion of raw materials by the locomotive builders to the manufacture of defense products.

On November 1, steam locomotives awaiting repairs were 2377 less than a year ago, and totaled 3778 units. Undoubtedly, a large number of unserviceable units represents over-age locomotives which cannot be repaired satisfactorily. Without a detailed survey, it is impossible to judge the practical availability of additional locomotives by repairing bad-order units.

As to the effective use of available service units, it is of interest to point out that whereas weekly carloadings showed an increase of about 100,000 cars, or 13 per cent, between November of 1940 and November of 1941, the number of locomotives in use on November 1 increased 8 per cent. This indicates, in general, an over-all increase in the effective use of locomotives.

Although there is no clearly defined program of locomotive production, due largely to a need for coordination between the railroad-equipment building program and other phases of the defense effort, it now looks as though the minimum number of locomotives which builders will be asked to deliver in 1942 would total 1000—half steam and half Diesel-electric. This means that orders for steam locomotives will have to be increased by about 200 units, since the backlog now numbers only a little over 300 units, many of which will be delivered by December 31. Orders for new Diesel-electrics will probably not be particularly large, since the backlog is now more than 500 units.

In attempting to line up the 1942 production schedule, the steam-locomotive builders must also take into account another phase of locomotive production, which is becoming increasingly important. This is the supplying of units to foreign countries, now turning to this country as the locomotive arsenal of the world.

Thus, in addition to supplying domestic requirements, it already appears that the builders of steam locomotives will have to provide for more than 300 units for export. Of this number, 33 will go to the Mexican railroads, with American Locomotive and Baldwin Locomotive each supplying about half. There will be 20 units for the Yunnan-Burma Railway, supplied by American Locomotive, and up to 250 for export under Lend-Lease provisions. These will probably be used in Egypt, filling the deficit left by motive power shifted to the Near East for transporting war materials to Russia. And the materials for manufacturing these units might receive priority over domestic requirements.

To sum up the question of motive power, then, as it is affected by the increasing burden it must haul during the coming year and by the foreign order requirements for locomotives, we find:

(1) There is a supply of 3778 unserviceable steam locomotives, of which we cannot say how many can be repaired and put back into service.

(2) There remained on November 1 of this year about 1600 serviceable locomotives not in use, which was about 500 less than the year before.

(3) The effective use of locomotives, in relation to the volume of carloadings, increased substantially between November, 1940, and November, 1941, as witnessed by an increase of 13 per cent in carloadings, and an increase of 8 per cent in locomotives in use.

(4) Although it appears, on the basis of U. S. total figures, that capacity to haul the domestic freight load may be increased during the current year through further repairing of bad-order cars, through further reductions in the stored and serviceable accounts, and through more effective use of locomotives in service—there is a need for building new locomotives because of the local situations obtaining among the various individual carriers.

(5) Foreign requirements are going to add substantially to the domestic requirements for steam locomotives.

(6) In spite of new demands made upon them for ordnance manufacture, there is still shop capacity among the manufacturers of locomotives to step up production sharply—depending upon the type of locomotive ordered.

(7) The holdup in the locomotive-building schedule has been due largely to the failure of the priorities system to provide enough steel.

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In bringing this talk to a conclusion, we arrive at the inevitable question: *What are we going to do about it?*

I am convinced, first of all, of the absolute necessity for immediate and continued, complete and unselfish cooperation of all individuals, companies, and agencies, both government and private, concerned with the transportation problem.

Secondly, it is absolutely imperative that the required materials be made available on schedule to car and locomotive builders. Freight cars and locomotives on paper are not freight cars and locomotives on the rails. We need raw materials. There are some indications that the government is becoming more acutely aware of the necessity of allocating sufficient steel for these purposes. We may have more success in obtaining necessary materials in the next year than we have had in the past year. But there are many uncertain factors, and it may be too much to hope that we will get all the materials we need.

We are faced with the very real probability of having to adjust ourselves to doing the best we can with what we can get, and with what we already have.

This is going to call for the exercise of imagination and ingenuity on the part of mechanical engineers. They will be called on not only to suggest the best ways to handle available material, but also to devise ways of using substitute materials to the best advantage. For example, as Mr. Young[1] has pointed out, alloy steels cannot be obtained at all, or only in limited quantities. This forces the use of carbon steel, which immediately poses a problem, namely, how to get the most out of this material, which increases dead weight for equal strength.

Doing the best we can with what we have may also call for designs simplified for the sake of rapid production—designs which may depart very little from the ideal desired by the purchaser, or may depart considerably. Every builder of cars and locomotives has a very complete library of modern, approved designs. He also has on hand the necessary dies, patterns, tools, jigs, and fixtures. Orders for new equipment could be filled rapidly and efficiently by using these designs, rather than starting in on new ones. This would mean "freezing" locomotive design during the wartime emergency. It was announced this week that the Association of American Railroads and the Office of Production Management have agreed on such a plan.

Another strong argument for the use of existing designs is the facility with which spare and repair parts could be obtained. And I am sure that there is unanimous consent in the industry to the pooling of designs, dies, tools, and general manufacturing equipment.

So far in this talk, we have projected our estimates of the increased hauling burden no farther ahead than 1942. I have pointed out that carloadings bear a relationship to the volume of industrial production and national income, and no reliable estimates of these factors are available today. Things are happening too fast, and the national scene is changing too rapidly to forecast 1943 conditions. No estimates made by government or private investigators can look farther ahead than the coming year with any degree of certainty. Our studies of the problem indicate, however, that while 1943 traffic conditions are largely unpredictable, the traffic burden will undoubtedly increase over the estimated 1942 level—*provided the war continues.* And one possible solution of the situation at that time may be not merely the *freezing* of locomotive designs, but the *restriction* of designs of *new* locomotives that will be made available. This is a likelihood which all of us should be turning over in our minds now.

I can think of no better way of closing than to quote the definition of mechanical engineering, given by President Harvey N. Davis of Stevens Institute, who has called it "the art of mobilizing materials, money, and men for the realization of projects beneficial to mankind."

This, gentlemen, is the problem. I submit that it is a problem for the best mechanical-engineering brains we can muster in this country. And upon the solution to this problem depends to a very important degree our success in becoming the Arsenal of Democracy, which is the goal that America has set for itself.

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[1] See companion paper by C. D. Young in this issue.

INDUSTRY ALSO MEANS PEOPLE[1]

By IRVING KNICKERBOCKER

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

THE phrase "an industrial organization" is a commonplace today. When we use it we mean a collection of machines and men organized for some purpose. A great deal of thought has been spent upon the machines and upon the organization of the machines. Our success with this has made us an outstanding industrial nation. Every day the newspapers present to us new evidence that we have not been so successful with the organization of men. That organization cries out for attention.

It seems evident that wherever men work together toward some end, there must be some degree of collaboration. We might even agree that the higher the degree of collaboration, the more efficient the working together. Our tendency in the past has been to take this aspect of organization for granted. We have assumed collaboration as a natural concomitant of men working together. Occasionally we have even talked about it, usually using the term cooperation. Inasmuch as we took cooperation for granted, we didn't study it. Since we haven't studied it, we have very little understanding of it. Because we don't understand it, when we need it we find it difficult to get. Whether we think in terms of civilization at large or in terms of one industrial organization, the problem of cooperation, how to study it, understand it, and get it, seems to grow increasingly important.

The book, "Management and Morale,"[2] is made up largely of addresses given to businessmen. These addresses are centered about the subject of human collaboration in modern industry. Their purpose is to emphasize the fact that this aspect of industrial organization has been neglected, and to present a point of view from which it is hoped that businessmen may be able to study, understand, and control collaboration.

As an introduction the author summarizes the Western Electric researches which, he says, "seem to me like a beginning on the road back to sanity in employee relations because (1) they offer a fruitful working hypothesis, a few simple and relatively clear ideas for the study and understanding of human situations in business; (2) they offer a simple method by means of which we can explore and deal with the complex human problems in a business organization—this method is a human method: it deals with things which are important to people; and (3) they throw a new light on the precondition for effective collaboration."

The Western Electric researches started some 16 years ago with a series of experiments on illumination. Their purpose was to find out the relation of the quality and quantity of illumination to the efficiency of industrial workers. The men who began at that point and continued the study through years were, to put it in the author's words, "true experimenters, that is, men compelled to follow the implications of their own monkey business." Although they started working on a simple and direct relation between certain physical changes in the worker's environment and his responses to them, they were forced step by step away from the more simple and measurable factors with which they began working, toward vague, unmeasurable human factors. They found that the responses of the employees to changes in their immediate working environment can be understood only in terms of their attitudes. The meaning of the change seemed to be more important than the change itself and seemed to depend upon the man, the individual man, affected by the change. "The 'meaning,' therefore, which any individual worker assigns to a particular change depends upon (1) his social 'conditioning,' or what sentiments (values, hopes, fears, expectations, etc.) he is bringing to the work situation because of his previous family and group associations, and hence the relation of the change to these sentiments; and (2) the kind of human satisfactions he is deriving from his social participation with other workers and supervisors in the immediate work group of which he is a member, and hence the effect of the change on his customary interpersonal relations." Probably the most startling new fact to come out of this research was that a worker in an industrial organization is not "an isolated, atomic individual; he is a member of a group, or of groups. Within each of these groups the individuals have feelings and sentiments toward each other, which bind them together in collaborative effort. Moreover, these collective sentiments can, and do, become attached to every item and object in the industrial environment—even to output. Material goods, output, wages, hours of work, and so on, cannot be treated as things in themselves. Instead, they must be interpreted as carriers of social value."

The fact that during years of research a group of tough-minded individuals were carried from "illumination" to "sentiment" and "social values" is probably indicative of a trend which must be taken by an increasing amount of research in industrial fields even though that research is pointed, as this one was, toward the end of output and efficiency. The problems of such research are inevitably human. As these men found out, the tools, at least for the time being, must be human. The data collected are human; the final solution must be human. "Workers are not isolated, unrelated individuals; they are social animals and should be treated as such. This statement—the worker is a social animal and should be treated as such—is simple, but the systematic and consistent practice of this point of view is not. If it were systematically practiced, it would revolutionize present-day personnel work. Our technological development in the last hundred years has been tremendous. Our methods of handling people are still archaic. If this civilization is to survive, we must obtain a new understanding of human motivation and behavior in business organizations—an understanding which can be simply but effectively practiced. The Western Electric researches contribute a first step in this direction."

The significance and importance of the social aspect of industry, stressed again and again throughout the book, is summed up in the following quotation:

> Each industrial concern has a social as well as a physical structure. *The social structure of any particular company determines the kind of collaboration, the kind of people who will stay in the company, and the kind of people who will reach the top.* Each employee not only has a physical place but he also has a social place in the factory. Any technical change on the part of management may therefore affect not only the physical but also the social location of an individual or group of employees. This

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[1] One of a series of reviews of current economic literature affecting engineering prepared by members of the department of economics and social science, Massachusetts Institute of Technology, at the request of the Management Division of The American Society of Mechanical Engineers. Opinions expressed are those of the reviewer.

[2] "Management and Morale," by F. S. Roethlisberger, Cambridge, Mass., 1941.

fear of social dislocation is likely to be a constant threat to the social security of different individuals and groups of individuals within the industry.

Throughout the Western Electric research the interview was used in order to gather and check material. In fact it might be claimed that the most important tool used in that research was the interview. The interview material was instrumental in changing the direction, the meaning, and the goals of the research. Naturally, the methods used for interviewing also underwent changes in the course of the work. Inasmuch as we all use the interview method almost daily no matter what our work, the following summary of practical rules may prove interesting. (1) Listen patiently before making any comments. (2) Don't disapprove until you know what you are disapproving of. (3) Don't argue. (4) Don't pay so much attention to what a man is saying that you fail to find out what he is trying to say. (5) Listen, not only to what he says but also to what he does not want to say or cannot say without assistance.

The analysis of material gained from interviews led to an increasing realization of the importance of words and their significance in the social organization of industry. Here it is necessary to understand the author's concept of "sentiment" and the differentiation of sentiments from another class of phenomena with which they are often confused, namely, facts. "Facts have two essential properties: They are conclusions about matters of observation, and they involve terms for which there exist certain operations that can be agreed upon as defining them." An example of a factual statement would be "The temperature in this room is 70 F." Sentiments refer to "a vast range of feelings, emotions, and attitudes, some of which are normal, some of which are pathological. They include those things within people which are appealed to by such statements as the following: 'The Constitution should be preserved;' 'There can be only one capital, Washington or Berlin;' and 'Woman's place is in the home.' " An example of an expression of "sentiment" of the same order as the one already given illustrating the factual statement would be, "This room is too hot." Obviously the expression of "sentiment" concerning the temperature of the room can lead to quite an argument, the expression of fact to none. It is emphasized then that: (1) Many words are used both by management and the worker that not only communicate information but also convey sentiments. (2) People do not have the same sentiments. "Their sentiments vary with age, sex, personal situations, official rank, and informal position in the organization." (3) Therefore, "some words which are very meaningful to some members, or some parts of the organization, may have little or no meaning, or different meaning to other members and different parts of the organization." (4) It is necessary, then, to have learned both the sentiments and the words commonly used to express them, of the groups or individuals to whom one is talking.

It becomes apparent that if the concepts dealt with so far are to be applied within the industrial organization, something brand new in the way of a personnel department must eventuate. The adequate personnel management must meet the problem of how to secure collaboration among members of the working force, in terms of: "(1) Problems relating to the channels of communication within the organization through which employees can learn about their duties and obligations in relation to the economic purpose, as well as express their feelings and sentiments about their methods and conditions of work; (2) problems of maintaining a condition of balance within the internal organization such that employees, by contributing their services, are able to satisfy their desires and hence are willing to cooperate; and (3) problems of effecting individual adjustments, whereby particular employees who are having difficulties can be assisted to become better oriented to their situations."

"It is a curious fact that there are certain areas of endeavor where those who teach do not practice and those who practice do not teach." Handling human relations or more specifically getting collaboration certainly appears to be such an area. In business there are men who are exceedingly skillful in this area. "Unfortunately, however, these men often cannot state their skills explicitly. Put them in charge of a group of men doing a definite job, and they come to life. Ask them to relate how they handled a particular problem, and they show uncanny insight. Put them on a platform and ask them to discuss the principles of managing men, and they grow red in the face and indulge in endless wheezes about human nature in general."

On the other hand, there is a class of social scientists whose "members are legion and bear many different labels. Some have 'chairs' in academic institutions; some do not. They all, however, have certain characteristics in common. Unlike the inarticulate men of action, they are people who are very articulate in discussing matters with which they sometimes have little firsthand acquaintance or experience. Some of them are 'teachers,' but they do not practice any skills, other than verbal ones, relating to social phenomena. They do not take into account the importance of the quality of judgment which is acquired by men of practical affairs. They hardly ever have the experience of making decision and acting under the burden of responsibility. Hence, they indulge more freely in the kind of irresponsible talk and thinking so annoying to men of action."

Despite the somewhat appalling dichotomy evidenced in these two quotations, the author feels, "that concrete events involving the interactions of people, which have been here referred to as 'cooperative phenomena,' constitute a class of phenomena which can be clearly segregated from other phenomena and can be studied for its own sake." "For its study, a simple point of view can be formulated, simple methods can be developed, and simple uniformities can be observed, stated, and applied. In all these major aspects, it has the necessary characteristics of a legitimate discipline that can stand on its own feet and be studied for what it is worth."

The influence of the Western Electric researches and the interest and enthusiasm of the men—the author is one—who participated in them have given impetus to the pursuit of just such a discipline. In several universities groups of men are now devoting their time to the study of cooperative phenomena in industry. They practice and learn in industrial organizations, and their ability and knowledge may be measured in terms of their actual success as consultants. So the problem of "men who do" versus "men who teach" is rather simply solved by men who both teach and do. It is hoped and expected that through such an approach the chasm which seems to separate the practicing manager of men and the theorizing social scientist may be bridged, that students may be equipped with some understanding of human relations in industry, and that systematized knowledge and industrial practice in the area of cooperative endeavor can be improved.

This book presents for consideration a problem of tremendous practical importance in industrial organization and human endeavor, which has been to a great extent unrecognized and therefore neglected by the business executive. Not only does the author delineate the area for study, but he presents possible tools and methods of attack. For the business executive or any other reader involved in cooperative endeavor—and most of us are—"Management and Morale" will be one of those books some of the contents of which become insensibly a part of his way of thinking.

To A.S.M.E. Members:

THE COUNCIL REPORTS FOR 1941

OBJECTS

THE constitution of The American Society of Mechanical Engineers states that "the objects of this Society are to promote the art and science of mechanical engineering and the allied arts and sciences; to encourage original research; to foster engineering education; to advance the standards of engineering; to promote the intercourse of engineers among themselves and with allied technologists; and severally and in cooperation with other engineering and technical societies to broaden the usefulness of the engineering profession."

This report recites the year's principal efforts to attain these objectives.

NATIONAL DEFENSE

The second year of international conflict saw the United States hard at work on its defense program. The building of new plants, and the conversion of old to the building of ships, planes, tanks, guns, and explosives brought increased problems to the engineering profession and particularly to mechanical engineers. The members of the Society, its officers, and past-officers are to be found in positions of public responsibility in the solution of the defense problems and the individual members in the uniformed forces, in professional practice, in industry, and in education are spending long hours to overcome the difficulties arising from a change from a peacetime program to an extensive defense program.

It is fitting therefore that "to broaden the usefulness of the engineering profession" this Society support the defense program with the full extent of its organization.

Our meetings and publications, the traditional functions of an engineering society, have been largely focused on defense problems. In the year, nearly one hundred meetings of the Society, the Divisions and the Sections were devoted to defense. Your President has delivered more than twenty-five addresses over the radio and to groups of engineers so that the engineering profession and the public may have sound understanding of the engineering implications of modern mechanized warfare. In addition to special defense emphasis at the national meetings at New York, Atlanta, and Kansas City, five special meetings devoted entirely to defense problems were held at Cincinnati, Cleveland, Philadelphia, Pittsburgh, and St. Louis. These latter meetings, enthusiastically supported, were of great value to those concerned with production problems of munitions manufacture.

Through the Engineering Division of the National Research Council, the Society is participating in the extensive program of research and development which is a vital part of modern defense. In particular, the Society with the support of the Army and Navy has organized a special research committee on the forging of steel shell.

In civilian defense, the chairman of the A.S.M.E. National Defense Committee represents the Society on a joint engineering body engaged in studying the technological problems relating to the protection of the civil population.

The defense requirements for materials give rise to serious problems. At the suggestion of the Office of Production Management, the officers of the Society gave vigorous leadership to the organization of the Engineers' Defense Board, a joint body charged with the responsibility of informing engineers about critical material shortages and about methods of overcoming or designing around them.

Many members of the Society, both teachers and professional engineers, have given freely of both time and effort to insure the success of the various Emergency Defense Training Courses now offered. These courses aim at upgrading men in defense industries so that shortages of man power in the upper ranks can be partially provided for.

The spreading of defense contracts among small industries as a means of offsetting machine-tool shortages and of avoiding the closing down of small shops because defense needs have taken the materials they normally use, presents a tremendous engineering problem in which the Society is concerning itself nationally and locally by the designation of representatives on the Defense Contract Distribution Section of the Office of Production Management.

The many activities of the Society in forwarding national defense are under the general guidance of the Committee on National Defense. This committee has met at intervals in Washington with representatives of the War and Navy Departments and has concerned itself with many important problems of production, design, education, and the selective service. In addition to his work on the committee, the chairman addressed nearly thirty meetings of the Sections.

The Society has also attempted to look forward to the time when the defense effort will occupy a smaller part of our national economy than at present. As a result of Past-President Batt's address at the 1940 Annual Meeting, some thought and effort are being devoted to the stimulation of research so that industry, greatly expanded for defense, may have outlet for its efforts when the defense production peak has been passed.

THE PROGRAM OF THE SOCIETY

In addition to the supreme effort to support National Defense, the Society has continued "to promote the art and science of mechanical engineering and the allied arts and sciences" through its 17 professional divisions, 70 local sections, 119 student branches, 16 standing, 12 special, and 26 joint committees, all of which involve the organized efforts of some 3000 members.

As part of a forward-looking program to arouse the interest of the members in the basic purposes of the Society, the Council invited Dr. William F. Durand, past-president, to prepare a paper on the aims and objects of the Society. Doctor Durand's paper appeared in the September issue of MECHANICAL ENGINEERING for comment by the individual members of the Society.

The activities of the Society are largely the result of activities of the standing committees and joint bodies whose reports in full are available on request. Digests of these reports are grouped into three divisions: I—Promoting the Art and Science of Mechanical Engineering; II—The Engineering Profession; and III—Administration of the Society.

I—PROMOTING THE ART AND SCIENCE OF MECHANICAL ENGINEERING

Progress is well illustrated by Table 1 of meetings and by summaries of the reports of committees:

TABLE 1 ANALYSIS OF PROGRAMS OF NATIONAL MEETINGS, PROFESSIONAL DIVISIONS

Meetings	Papers and addresses	Authors	Total registered
Society			
Annual, New York, Dec. 2–6, 1940	110	159	2488
Spring, Atlanta, Mar. 31–Apr. 3, 1941	28	33	510
Semi-Annual, Kansas City, June 16–20, 1941	66	72	506
Professional Divisions			
1 Manufacture of Shell, Cincinnati, Ohio, Oct. 16–17, 1940	8	8	331
2 Fourth AIME-ASME Fuels, Birmingham, Ala., Nov. 7–9, 1940	16	16	204
3 Army and Navy Meeting, National Defense, Cleveland, O., Mar. 12–13, 1941	14	16	344
4 Management Conference on National Defense, Philadelphia, Pa., Apr. 22–23, 1941	7	11	260
5 Textile Meeting, Greenville, S. C., Apr. 3–4, 1941	2	2	100
6 Fourth A.S.M.E. National Defense Meeting, Pittsburgh, Pa., May 2, 1941	10	10	300
7 Oil and Gas Power, Kansas City, Mo., June 11–14, 1941	14	16	201
8 Eighth Applied Mechanics, Philadelphia, Pa., June 20–21, 1941	18	21	119
9 National Defense, St. Louis, Mo., Sept. 9–11, 1941	27	27	270
Total	320	391	5633
Corresponding Totals for 1939–1940	209	252	4835

MEETINGS AND PROGRAM

The meetings activity has been discussed under previous headings. It is necessary to point out that the Annual Meeting in New York has outgrown the capacity of the Engineering Societies Building and was therefore held at a hotel. The successful meeting at a hotel during the 1939 Annual Meeting in Philadelphia set the precedent for this change. A policy of charging for preprints of papers was adopted to provide necessary funds to render this increasingly costly service in a more satisfactory manner.

PUBLICATIONS

The problems claiming the attention of the Committee on Publications during the last year have, in general, had their origin in the expansion in the number of papers presented at national meetings of the Society which has been more rapid than the increase in funds available for printing. Partial relief was afforded by slight increases in the current appropriation. Action by the Council in an attempt to bring the number of papers offered at future meetings into better balance with funds available for publication, will, it is hoped, result in publication service more satisfactory to members.

During the fiscal year 77 papers were published in Transactions, 111 in MECHANICAL ENGINEERING (of which 74 were presented at Society meetings), and 25 in the *Journal of Applied Mechanics*. A Sixty-Year Index of A.S.M.E. papers was also issued. This is a complete finding list of all technical papers, grouped topically and arranged chronologically. Its form is simple and practical.

PROFESSIONAL DIVISIONS

The professional divisions cooperated in the meetings on national defense and the national Society meetings. Progress was made in developing better papers written in more concise form to save publication space. The Heat Transfer Group was reorganized as a division. Aeronautic Division was changed to Aviation Division. Another important development was the effort of the divisions, particularly Aviation and Management, to secure local sections' participation in the work of the divisions by appointing local liaison members.

BOARD ON TECHNOLOGY

The Board on Technology, a coordinating body dealing with the policies of meetings, research, publications, and divisions, and local sections is made up of a member of the Council as chairman, two members-at-large and a representative of each of the foregoing activities. During the year it recommended policies of (1) a balanced program of meetings and publications, (2) charging for preprints, and (3) the appointment of divisional research secretaries. It advised against company memberships and is now considering the wisdom of converting two national meetings each year into divisional meetings.

LOCAL SECTIONS

The Local Sections Committee directed effort to the formulation of a long-range program which will seek "*to define for each local center suitable activity objectives* shaped to the individual-member need and in harmony with Society Aims and Objects, *to stimulate leadership for the attainment of these objectives*, and to *provide quantitative measures* of progress toward these objectives."

A praiseworthy innovation occurred in one of the smaller sections, Washington, D. C., lacking the resources possessed by the larger sections. It took real imagination, rare ability, and commendable courage for Col. Glen F. Jenks and the executive committee of the Washington Section to pioneer a series of lecture courses on applied mechanics. The effect of these courses was far-reaching in member benefit.

The recommendations of the 1940 Group Delegates Conference have been diligently reviewed by the Committee on Local Sections with an active follow-up that has been effective.

STUDENT BRANCHES

Substantial growth of Student membership and of student-branch activity has continued during the last year without serious interruption, although the ultimate effect of war and defense activities cannot clearly be foreseen at this time and should seriously concern the Society, so important a contributing factor has the student membership become.

The present plan of student activity has moved forward rapidly, gaining appreciably in membership, in vigor, and in general favor. Surprisingly few complaints have been received during the last year. It has definitely entered the cycle of smooth, orderly operation.

In 1932, with the plan completing its first year, 193 were transferred from Student to Junior membership, with but 46 completing this transfer by payment of Junior dues. In 1939, 2420 were transferred, with 1105 completing the transaction. In 1940, 2918 were elected with time limit for transfer October 1, 1941, 1081 completing the transfer by June 1. In 1941, 3034 were elected.

There are now 119 student branches with a membership during the last year of 7031, during which they held 709 student branch meetings.

During the year ten regional conferences, with an attendance of nearly 2000, were held in this country, at different key points chosen primarily to give maximum attendance of student members.

EDUCATION AND TRAINING FOR THE INDUSTRIES

The Committee on Education and Training for the Industries emphasized the national importance of education and training in the Defense Program and held five sessions at the national meetings of the Society.

LIBRARY

The library was used by 40,576 persons during the year, of whom 10,395 lived at a distance and were assisted by correspondence. This involved making 64 extensive bibliographies, 119 translations, 21,679 photoprints, and 14 microfilms for 2478 individuals.

Contract has been let for improved lighting of the reading room.

PROFESSIONAL CONDUCT

No cases were reported to the Committee on Professional Conduct which requested that members of the Society "observe and report cases of improper conduct" in order that the profession may guard and improve its ethical standards.

RESEARCH

The research program of the Society covers a wide range of interest and cooperation. Of the 17 special projects, 13 reported commendable activity which was reflected in 11 published progress reports and 10 papers before Society meetings. The subjects under active investigation are:

1 Properties of lubricants under high pressure.
2 Mathematical analysis of partial bearings of finite width.
3 Study of volumeters to determine elements which affect calibration.
4 Surface endurance of gear-teeth materials.
5 Fatigue tests on helical springs.
6 Tubular members subjected to internal pressures.
7 Properties of metals at low temperature.
8 Effect of variables on the high-temperature properties of metals.
9 Comparison of short- and long-time creep-test methods.
10 Caustic embrittlement and intercrystalline corrosion of boiler steel.
11 Viscosity of superheated steam.
12 Corrosion of unstressed steels and various alloys.
13 Effect of speed deformation on the forming of metals.
14 Laboratory study of cold-rolling of steel.

Two new committees were organized: (1) Furnace Performance Factors, and (2) Forging Steel Shells.

The functions and procedures of the Committee on Research were thoroughly reviewed and the findings published in the March issue of MECHANICAL ENGINEERING. One of the results of this study was the appointment of a research secretary by each professional division. This should result in closer cooperation between research and program making.

STANDARDIZATION

The output of Society standards was much larger than usual. Twelve standards were developed by sectional committees, completed and presented to the A.S.A. for approval. Among these twelve standards are the following six new standards which are appearing for the first time:

Steel Butt-Welding Fittings
Soldered-Joint Fittings
Reamers
Preferred Thickness for Uncoated Thin Flat Metals (Under 0.25 In.)
Acme and Other Translating Threads
Screw-Thread Gages and Gaging.

Three revisions of standards and two additional standards have been completed and submitted to the sponsoring organizations on their way to the A.S.A. Progress was reported on three more, drafts of which have been distributed to industry for critical review. Twenty-one reports are in various stages of development.

POWER TEST CODES

The major effort is to keep the revisions of test codes up to date. The "Test Code for Steam Turbines" was completed and approved by the Council in March, 1941. Three new sections on "Instruments and Apparatus" were completed.

Subcommittees and joint committees are studying codes for fuels testing; coal pulverizers; centrifugal and rotary pumps; blowers; refrigerating systems; steam locomotives; internal-combustion engines; hydraulic prime movers; and other subjects, all significant of progress and leadership.

SAFETY

The Safety Committee is responsible for safety codes on elevators, dumbwaiters, and escalators; mechanical power-transmission apparatus; compressed-air machinery and equipment; conveyers and conveying machinery; cranes, derricks, and hoists; and jacks, which are developed by sectional committees under A.S.A. procedure. These committees have all been active during the last year with the exception of Sectional Committee on Compressed Air Machinery and Equipment which completed its report in 1939.

The "Safety Code for Jacks" was submitted to the A.S.A. for approval; a supplement to the "Elevator Code" will be published late in 1941; the first draft of the "Safety Code for Conveyers and Conveying Machinery" was completed; and the final draft of the Safety Code for Cranes, Derricks, and Hoists" was completed during the year and has been submitted to the sponsoring bodies for approval.

BOILER CODE

The Boiler Code Committee during the fiscal year 1940–1941 has been actively engaged in interpreting the "A.S.M.E. Boiler Construction Code" and formulating revisions and addenda. Some of the more important activities other than routine are revision of the rules for thickness of steam and feedwater piping; changes in the allowable working stresses for ferrous materials; clarification of procedure involved in the use of manufacturers' data reports and stamping requirements for boilers and pressure parts; clarification of the scope of the "Unfired Pressure Vessel Code" with regard to pressure and size limitations. The committee has also issued special rulings permitting substitution of certain materials which are more readily available than those provided for in the code to meet the present industrial emergency in connection with constructions for defense work. New rules have been added in the "Unfired Pressure Vessel Code" to provide for the use of tubes and pipe in unfired pressure vessels and special rules have also been issued for the use of deoxidized copper and Monel metal in welded unfired pressure vessels.

HONORS AND AWARDS

During the year the following honors were awarded:

Honorary memberships to William L. Abbott, Robert W. Angus, Arthur M. Greene, Jr., Albert Kingsbury, and James A. Seymour.

A.S.M.E. Medal to Charles F. Kettering.
Holley Medal to Edwin H. Armstrong.
Worcester Reed Warner Medal to William Benjamin Gregory.
Melville Medal to Carl A. W. Brandt.
Pi Tau Sigma Medal to George A. Hawkins.
Junior Award to Robert E. Newton.
Charles T. Main Award to Frank DePould.
Postgraduate Student Award to George W. Shepherd, Jr.
Undergraduate Student Award to Edward D. Rowan.
Spirit of Saint Louis Medal to John E. Younger.
Spirit of Saint Louis Junior Medal to Wilbur W. Reaser.

II—THE ENGINEERING PROFESSION

This Society cooperates with other engineering associations, through joint committees and representatives organized for special purposes designed to aid in the development of the engineering profession. The following section reviews briefly the activities of joint bodies and of the related committees and representatives of the Society.

The Council of this Society has traditionally supported those movements which look to the solidarity and unity of the engineering profession. The abandonment of the American Engineering Council (reported in the following paragraph) directed attention to the need for a means for securing a meeting of minds on the common problems of the profession and, accordingly, this Society upon vote of the Council called a meeting of the presidents and secretaries of the Founder Societies to be held shortly after the close of the fiscal year. The present period of national emergency calls for effective united action by all national groups and the engineering profession should be in a strong position to take such action.

AMERICAN ENGINEERING COUNCIL

During the summer of 1940, both the American Society of Civil Engineers and the American Institute of Electrical Engineers gave notice of their intention to withdraw from the American Engineering Council as of Dec. 31, 1940. After conferences at which the matter was discussed at length, it was the consensus that the withdrawal of these two societies made it impossible for the A.E.C. to continue and that it was desirable that it be terminated immediately. By formal vote of the Executive Committee of this Society, on Nov. 8, 1940, our representatives on A.E.C. were directed to urge an early meeting of A.E.C. to close up its affairs by Dec. 31, 1940.

There was general agreement that there were many worthwhile tasks to be performed jointly by the engineering profession in Washington, and the Executive Committee authorized the President and the Secretary to consult with officers of other societies on problems related to A.E.C. and the establishment of a new organization to replace it. This Society holds the view that the larger engineering societies should have a joint office in Washington, to provide means of contact between government departments and the individual societies and aid individual members of the Society in their contact with government.

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

E.C.P.D. is directed to coordinate and promote efforts and aspirations directed toward higher professional standards of education and practice.

The E.C.P.D. Committee on Engineering Schools reported on Sept. 30, 1941, that the status of the accrediting program was:

Curricula recommended for accrediting unconditionally	463
Curricula recommended for accrediting for limited period (one or two years)	102
Curricula recommended to be not accredited	166
Curricula on which action is pending	24
Reinspections of curricula previously accredited unconditionally but on which action is pending	10
Reinspections resulting in no change in status of curricula	131
Total	896

The E.C.P.D. Committee on Professional Recognition has continued its efforts to evaluate the engineering profession, correlate society activities in promoting the professional aspects of engineering, the teaching of ethics, and a better understanding of E.C.P.D.

E.C.P.D. instituted a successful innovation at the Kansas City meeting of A.S.M.E. by conducting a series of sessions devoted to the various problems dealt with by E.C.P.D.

The E.C.P.D. Committee on Student Selection and Guidance has continued to sponsor guidance committees of engineers to cooperate with high schools. Local sections have also assisted.

The E.C.P.D. Committee on Professional Training has extended its procedure in helping the junior engineer to find his proper place in the profession. On the quality and progress of the junior depends the future of the profession.

The E.C.P.D. Committee on the Principles of Engineering Ethics is preparing a statement to be presented to E.C.P.D. and the constituent societies.

NATIONAL CONFERENCE ON ENGINEERING POSITIONS

Four representatives from each of eight national engineering societies form the National Conference on Engineering Positions whose purpose is to study the classification of engineers' compensation, social, and industrial effects of engineering. The work is now more or less dormant because of defense activities.

The Council of A.S.M.E. asked the A.S.M.E. delegation on the National Conference to consider a description of mechanical engineering. After considerable study and inquiry, and from suggestions submitted, the following was presented for record but not for official adoption:

> Mechanical engineering is the art and science of generating, transmitting, and utilizing heat and mechanical power; of the production of tools, machinery, and their products; including research, development, design, application, and management.

NATIONAL RESEARCH COUNCIL, DIVISION OF ENGINEERING AND INDUSTRIAL RESEARCH

The Division of Engineering and Industrial Research of the National Research Council organized and conducted a tour of research leaders of the United States to six countries of South America. An Industrial Research Institute was organized to provide for the study of research organization and management in industry. Aircraft production was the subject of a survey to determine unit costs. The office of the Division was moved to Washington.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The program for Section M (Engineering) which met in Philadelphia, Dec. 31, 1940, was on "Relations Between the Americas," and included addresses on "Cultural Relations Between the Americas," by President C. H. Marvin, of George Washington University; "The Press and Inter-American Relations," by Raymond Clapper, Washington, D. C.; "Interchange of Students Between the Americas," by Richard Pattée, U. S. Department of State, Washington, D. C.; "Engineering Developments in South America," by Fred Lavis, consulting engineer, New York, N. Y.; "Inter-American Relations in the Field of Engineering Materials," by C. L. Warwick, secretary, American Society for Testing Materials, Philadelphia, Pa., and "Exchange of Standards Between the Americas," by P. G. Agnew, secretary, American Standards Association.

Dean W. R. Woolrich, A.S.M.E., is vice-president-elect; Dean F. M. Feiker, A.S.M.E., secretary of Section M.

THE ENGINEERING FOUNDATION

Aid was provided to assist a wide variety of research projects, of which the following A.S.M.E. projects for which the

Standing Committee on Research was granted funds are typical: Rolling of Steel; Critical Pressure Steam Boilers; Fluid Meters; Cottonseed Processing.

It is with sincere regret that report is made of the death, on April 15, 1941, of Dr. Otis E. Hovey, director of the Foundation since 1937.

NATIONAL BUREAU OF ENGINEERING REGISTRATION

The National Bureau of Engineering Registration, under the National Council of State Boards of Engineering Examiners and an advisory board of representatives from the principal national engineering societies, registers professional engineers who meet or exceed the requirements of the Model Law. Applicants must be first registered in their own home states. Education and professional experience and competence are thoroughly verified. Certificates are then issued to those meeting the required standards.

Certificates are legally acceptable evidence in most states for applications for professional engineers' registration. They also are valuable references in obtaining positions, consulting work, or other service.

At the invitation of this Society and the American Society of Civil Engineers, the National Council of State Boards of Engineering Examiners scheduled its 1941 convention in New York City in October. It was felt that such a meeting would afford an opportunity for members to become informed about the registration movement.

REGISTRATION

The benefits to come to the public and to the profession from the registration of professional engineers are generally admitted. To secure the full effect, registration must be understood, properly guided, and generally supported.

Professional engineering practice is not confined within state borders. Hence, state laws and regulations governing it should be uniform. There should be liberal reciprocity as between the states. The National Council of State Boards of Engineering Examiners promotes these purposes. The Society supported the National Council last year by disseminating its publications to the officers of the local sections and other interested individuals in the Society.

III—ADMINISTRATION

MEMBERSHIP

Table 2 shows that the total membership increased during the year from 14,846 to 15,714. The total number of Junior members increased by 822 and the number of Members increased by 44. The Committee on Local Sections is responsible for a program to attract men of recognized standing in engineering (and the figures show the results of their work).

The following table shows the work of the Committee on Admissions during the year:

Total applications considered during the year 1940–1941	4046
Additions to Fellow grade	35
Additions to Member grade	429
Additions to Junior grade	3273
Total additions to membership	3737

BOARD OF REVIEW

Of the 377 cases referred to the Board of Review, 337 or about 90 per cent, consisted of resignations and reinstatements. The reduced numbers in each of these classes of cases, roughly 25 per cent, during the last year reflects the effect of improved financial conditions.

CONSTITUTION AND BY-LAWS

The committee lays down the following principles for guidance in considering changes:

1 A Constitution of the Society, which represents the fixed rules, should be as simple and short as possible and only contain the necessary rules to safeguard the operations of the Society.

2 The By-Laws, which are the most easily changed part of the operating rules, should also be as flexible as possible but should set up definite procedures to guide all of the officers and members of the Society in their dealings with it.

At the meeting of the Council, Dec. 2, 1940, the By-Laws were amended to define the duties and responsibilities of the Standing Committee on Research.

ENGINEERING SOCIETIES PERSONNEL SERVICE, INC.

This service is conducted jointly by the national engineering societies and extends aid to the engineering profession through a competent and confidential solution of its personnel problems. From the registrations received through its four offices located in New York, N. Y., Chicago, Ill., Detroit, Mich., and San Francisco, Calif., and other cooperating local engineering groups throughout the United States, the files of the Service contain the records of more than 10,000 available engineers.

During the last year an extra burden has been placed upon the Service because of the numerous requests received from governmental departments, as well as private industry, to furnish them with highly qualified engineers for responsible positions in connection with the defense program and the Service has issued an invitation to several governmental agencies offering unlimited use of its files.

OFFICE OPERATION

As pointed out in the 1939–1940 report, the office is undermanned in respect to high-grade men to carry on the Society work and guarantee continuity. During the year Charles L. Tutt, Jr., was appointed as a staff assistant on a part-time basis to cover production problems. By increasing the sales price of the Boiler Code, funds were provided to furnish necessary technical assistance to that activity.

TABLE 2 CHANGES IN MEMBERSHIP

(September 30, 1940, to September 30, 1941)

	Membership		Increases			Decreases				Changes		
	Sept. 30, 1941	Sept. 30, 1940	Transferred to	Elected	Reinstated	Transferred from	Resigned	Dropped	Died	Increases	Decreases	Net changes
Honorary Members	23	19	5	...	...	...	...	...	1	5	1	+ 4
Fellows	127	114	19	1	1	3	...	...	5	21	8	+ 13
Members	8143	8099	97	256	86	21	105	183	86	439	395	+ 44
Associates	200	215	...	3	...	2	7	4	5	3	18	− 15
Junior (20)	995	1000	124	39	20	55	34	95	4	183	188	− 5
Junior (15)	789	743	276	47	10	163	25	97	2	333	287	+ 46
Junior (10)	5437	4656	...	1491	16	277	64	383	2	1507	726	+781
Total membership	15714	14846	521	1837	133	521	235	762	105	2491	1623	+868

The Secretary, who has held a commission in the Ordnance Reserve Corps, U. S. Army, since 1919, was called to active duty during the summer of 1940, and called again to active duty on Jan. 21, 1941, for a year. The Council voted to grant a leave to the Secretary for this purpose, continuing his official duties but appointing Ernest Hartford as executive assistant Secretary and engaging Dean R. L. Sackett as assistant to the Secretary in his absence. The Secretary has devoted his leave periods to the work of the Society. He is on active duty in the office of the Chief of Ordnance in Washington and in that position brings the facilities of the Society to the service of National Defense in a practical manner. Leave of absence was also granted to Leslie Zsuffa, member of the editorial staff of the Society, who had been called to active duty in the Quartermaster Corps.

COUNCIL MEETINGS AND ACTIVITIES

The Council held two meetings, at the Annual Meeting in New York in December, 1940, and at the Semi-Annual Meeting in Kansas City, Mo., in June, 1940. In addition the Southern members met at the Spring Meeting in Atlanta, Ga., March, 1941, and in Louisville, Ky., October, 1941.

The Executive Committee held seven meetings.

The President visited approximately 21 Local Sections and 11 student branches since January, in addition to the visits to the Sections and branches which were made by other members of the Council.

The Executive Committee held 8 meetings.

FINANCES

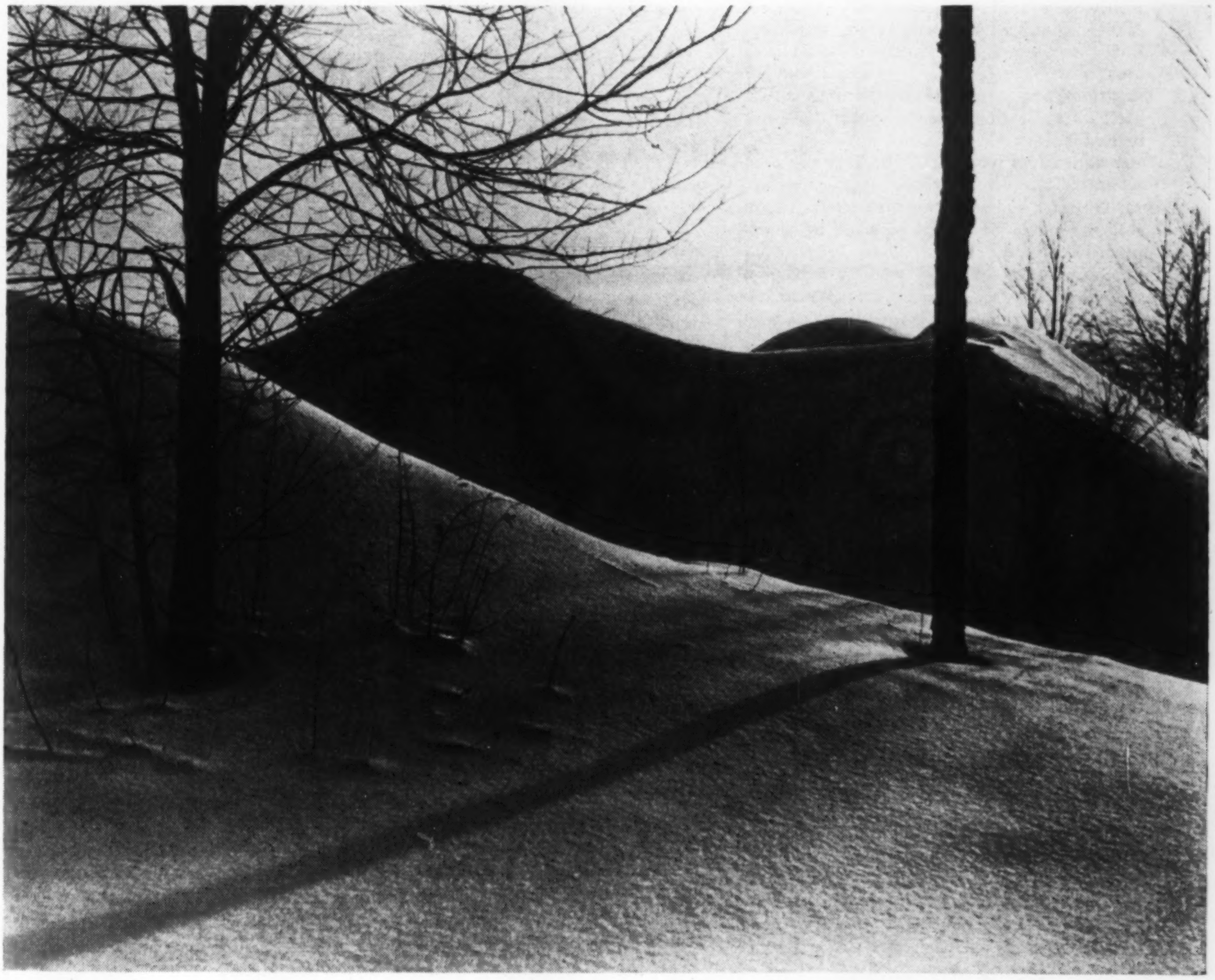
The complete report of the Finance Committee follows this report of the Council.

COMMITTEE REPORTS

The full reports of the Committees of the Society and of its representatives on joint agencies are embodied in a pamphlet of 52 pages which is available for distribution upon request to headquarters.

DEATHS

Among the members who died during the year were Hutchinson I. Cone, Honorary Member; E. W. Burbank, Charles R. Richards, and Earl F. Scott, former members of the Council; and W. LeR. Emmet, A.S.M.E. Medalist.



WINTER AFTERNOON

(Photograph taken by Leonard Ochtman, Jr., and shown at the Sixth Annual Photographic Exhibit held during the A.S.M.E. Annual Meeting, December 1–5, 1941, New York, N. Y. See page 65 for awards.)

A.S.M.E. FINANCE COMMITTEE REPORT, 1940-1941

Financial Review

THE Standing Committee on Finance submits the following as its report on the financial operations of the Society for the year ending September 30, 1941:

Operating Summary

- A Balance Sheet. Accountants' Certificate
- B Comparative summary of income and expenses
- C Statement of surplus
- D Detailed cost of activities
- E How the A.S.M.E. spent its 1940–1941 income.

BALANCE SHEET—EXHIBIT A

The Balance Sheet, Exhibit A, of September 30, 1941, shows, on that date, that the Society owed:

(1) One member who holds an unredeemed certificate of indebtedness with interest at date of redemption*........	510.00
(2) Current bills........	195.26
(3) Obligations for printing and distributing the 1942 Mechanical Catalog, bills for which have not been submitted........	13,548.96
(4) Other obligations for which bills have not been submitted........	24,380.24
(5) Special research and other committees which have collected funds for special purposes to be expended as needed........	30,021.52
(6) Future services to Members who have prepaid their dues........	73,491.02
(7) Advertisers and subscribers to publications who have prepaid........	4,004.20
	$146,151.20

To meet these debts the Society had:

(1) Cash in the bank........	105,524.04
(2) Accounts and note receivable........	50,134.98
(3) Inventories of publications and supplies conservatively valued at........	24,521.67
(4) Securities (at the lower of cost or approximate quoted market values):........	173,163.65
(5) Prepaid expenses of........	347.92
	$353,692.26

The difference between the value held by the Society of $353,692.26 and debts of $146,151.20 is the net worth of the Society on September 30, 1941........	$207,541.06

The Society had other liabilities:

(1) Trust funds amounting to........		$113,538.27
against which the Society had the following assets:		
(*a*) Cash........	$ 19,663.51	
(*b*) Notes receivable........	3,436.93	
(*c*) Securities (at the lower of cost or approximate quoted market values):........	90,437.83	
	$113,538.27	
(2) Property fund of........		$526,116.25
with the following assets to support it:		
(*a*) Quarter interest in building...	$498,448.48	
(*b*) Office furniture and fixtures (depreciated value)........	27,665.77	
(*c*) Library books........	1.00	
(*d*) Engineering Index, Inc.—Title and good will........	1.00	
	$526,116.25	
(3) Employees' Retirement Fund of........		$ 35,089.30
covered by:		
Cash........	$ 25,439.30	
Securities (at approximate quoted market value):........	9,650.00	
	$ 35,089.30	

The total of the Society's Investment and Trust Fund Portfolios is $273,251.48, of which approximately 51 per cent is Lawyers Mortgage Company certificates and wholly owned mortgages, the cost of which as shown in last year's report was $251,631.64 and with an appraised value of $141,414.21. Redemptions during the year have reduced the cost value to $249,401.42. The present appraised market value is $139,183.99. The cash income received during the year from these Lawyers mortgages and certificates was $11,524.73. Average yields on these real-estate mortgages and certificates were:

	Trust Fund Assets	Society Investments	Aggregate
Based on Cost......	4.57	4.64	4.62
Based on Market...	8.55	8.31	8.38

The Security Portfolio was enlarged during the year by the purchase of high-grade preferred stocks totaling $7,309.63 and U. S. Defense Bonds totaling $37,000.00.

INCOME AND EXPENSE—EXHIBIT B

The total income received during the year 1940–1941 was $55,077.97 more than that received during the year 1939–1940. The membership dues received were higher by $12,656.82 and revenues from MECHANICAL ENGINEERING advertising and Mechanical Catalog advertising were $17,368.77 more than received during 1939–1940. Revenue from publication sales was higher by $24,716.86.

SURPLUS—EXHIBIT C

Net Addition to Surplus for the year 1940–1941 is $29,841.73 or $2,823.18 less than last year; but from operations there is an increase of $2,590.75 more than the operations of last year.

If industrial prosperity coming from defense or war spending is considered fortunate, then your Society's prosperity might also be considered fortunate. Your Society was prosperous in the past and surplus funds were accumulated. During the depression serious inroads were made on these funds to the extent that borrowing became necessary to carry on even curtailed activities of the Society.

While good times are here, it is the hope of the Finance Committee that the surplus account will grow. Present prosperity will not continue indefinitely; a decline will come sooner or later. When this happens, your Society should have sufficient surplus to carry on essential activities or be faced with both financial difficulties and impairment of services.

J. L. KOPF, *Chairman*
K. W. JAPPE, *Vice-Chairman*
G. L. KNIGHT
E. J. GRIMMETT

J. J. SWAN
E. B. RICKETTS } *Council*
G. E. HULSE } *Representatives*
W. D. ENNIS, *Treasurer*

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* This indebtedness is no longer interest-bearing.

EXHIBIT A

BALANCE SHEET—SEPTEMBER 30, 1941

ASSETS

GENERAL FUND:			
Cash in banks and on hand (including $510.00 reserved for retirement of certificate of indebtedness)			$ 105,524.04
Accounts receivable:			
Dues—current year	$13,159.23		
Dues—prior years	890.00		
	$14,049.23		
Less—Reserve	14,049.23	—	
Publications and advertising	$52,071.88		
Less—Reserve	2,980.11	$ 49,091.77	
Miscellaneous		953.21	50,044.98
Note receivable			90.00
Inventories, at cost or less:			
Publications completed		$ 13,998.34	
Publications in process		10,700.42	
		$ 24,698.76	
Less—Reserve		3,384.02	
		$ 21,314.74	
Supplies		3,206.93	24,521.67
Securities (at the lower of cost or approximate quoted market values):			
Real estate mortgage bonds and certificates		$ 93,646.14	
Railroad and industrial stocks and bonds		42,517.51	
United States Defense Bonds—Series F		37,000.00	173,163.65
Prepaid insurance			347.92
			$ 353,692.26
EMPLOYEES' RETIREMENT FUND:			
Cash in banks		$ 25,439.30	
Real-estate mortgage certificate (at approximate quoted market value)		9,650.00	
			35,089.30
TRUST FUNDS:			
Cash in banks		$ 19,663.51	
Notes receivable (Major Toltz Fund)		3,436.93	
Securities (at the lower of cost or approximate quoted market value):			
Stocks and bonds	$53,019.98		
Real-estate mortgage certificates	37,417.85	90,437.83	
			113,538.27
PROPERTY FUND:			
One-fourth interest in real estate and other assets of United Engineering Trustees, Inc., exclusive of Trust Funds		$498,448.48	
Office furniture and fixtures (depreciated value)		27,665.77	
Library books		1.00	
Engineering Index, Inc.—Title and good will		1.00	
			526,116.25
			$1,028,436.08

LIABILITIES

GENERAL FUND:		
Certificate of indebtedness and accrued interest thereon		$ 510.00
Accounts payable		195.26
Accrued liabilities:		
Estimated liability relating to Mechanical Catalog for 1941–1942	$13,548.96	
Others (estimated)	24,380.24	
		37,929.20
Unexpended balances of Custodian Funds		30,021.52
Deferred credits:		
Dues and initiation fees paid in advance	$73,491.02	
Prepaid subscriptions (estimated)	4,000.00	
Prepaid advertising	4.20	
		77,495.22
Surplus (Exhibit C)		207,541.06
		$ 353,692.26
EMPLOYEES' RETIREMENT FUND		35,089.30
TRUST FUNDS (including unexpended income)		113,538.27
PROPERTY FUND		526,116.25
		$1,028,436.08

NOTE: Initiation and promotion fees receivable are not included in the above statement as they are taken up by the Society only as and when collected.

ACCOUNTANTS' CERTIFICATE

TO COUNCIL OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

We have examined the balance sheet of The American Society of Mechanical Engineers as at September 30, 1941, and the summary of income and expenses and statement of surplus for the fiscal year ending that date, have reviewed the system of internal control and the accounting procedures of the Society and, without making a detailed audit of the transactions, have examined or tested accounting records of the Society and other supporting evidence, by methods and to the extent we deemed appropriate.

In accordance with the practice followed by the Society in prior years, no effect has been given in the statements to accrued income on investments.

The membership dues are included in the income account of the current year on the basis of total cash received on account of that year and prior years, and provision has been made for all dues uncollected at September 30, 1941.

In our opinion, with the foregoing explanations, the accompanying balance sheet and related summary of income and expenses and statement of surplus present fairly the position of The American Society of Mechanical Engineers at September 30, 1941, and the results of its operations for the fiscal year, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

(Signed) PRICE, WATERHOUSE & CO.

New York, N. Y.
October 30, 1941

EXHIBIT B

COMPARATIVE SUMMARY OF INCOME AND EXPENSES

For the Two Years Ending September 30, 1941

	Year 1940–1941	 1939–1940
INCOME:		
Initiation and promotion fees (to surplus)	$ 9,837.57	$ 9,155.64
Membership dues*	$230,038.86	$217,382.04
Student dues	21,088.00	20,420.55
Interest and discount (net)	10,534.05	10,609.36
MECHANICAL ENGINEERING advertising	90,741.69	79,551.82
Mechanical Catalog advertising	47,730.00	41,551.10
Membership List advertising	....	668.00
Publication sales	80,510.02	55,793.16
Miscellaneous sales	2,096.95	1,619.10
Contributions—*Journal of Applied Mechanics*	1,200.00	1,350.00
Engineering Index, Inc	495.27	564.24
Registration fees	426.00	287.00
Sale of equipment	96.00	82.50
TOTAL INCOME	$484,956.84	$429,878.87
EXPENSES:		
Expenses under committee supervision (including appropriation of $20,000 to Employees' Retirement Fund in 1940–1941)	$ 94,280.08	$ 82,164.46
Publication expense	159,306.63	133,861.14
Office expense	212,014.07	197,087.96
TOTAL EXPENSES	$465,600.78	$413,113.56
Net income for the year	$ 19,356.06	$ 16,765.31

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* Membership dues have been stated on the basis of total cash received during the year.

EXHIBIT C

STATEMENT OF SURPLUS

Year Ending September 30, 1941

BALANCE, SEPTEMBER 30, 1940		$177,699.33
ADD:		
Initiation and promotion fees collected	$ 9,837.57*	
Net income for year (Exhibit B)	19,356.06	
Collections on Parker case judgment (net)	925.00	
Unused balance of life membership	37.72	
		30,156.35
		$207,855.68
DEDUCT:		
Adjustment (net) of carrying value of securities owned to the lower of cost or approximate quoted market value at September 30, 1941 (exclusive of adjustment of $1,661.46 in respect of Trust Fund investments charged to Trust Funds)		314.62**
BALANCE, SEPTEMBER 30, 1941		$207.541.06

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* As it is the practice of the Society to take up initiation and promotion fees only as and when collected, the above statement does not include such fees receivable at September 30, 1941.

** After giving effect to this adjustment, the carrying value of these securities is $89,164.24 below cost. Trust Fund securities are carried at $36,568.30 below cost.

EXHIBIT D

DETAILED COST OF A.S.M.E. ACTIVITIES 1940–1941

(*Approved by Finance Committee, September 30, 1941*)

	Expense under committee supervision	Printing and distribution expense	Office expense	Total cost 1940–1941	 1939–1940
Council	$ 5,203.84			$ 5,203.84	$ 6,448.69
Library	9,265.40			9,265.40	9,207.20
American Engineering Council	2,075.00			2,075.00	8,300.00
Engineers' Council for Professional Development	2,045.01			2,045.01	850.00
Finance Committee Expense	110.00			110.00	108.00
Awards	585.25		$ 486.93	1,072.18	1,301.87
Nominating Committee	698.82			698.82	485.96
Local Sections	22,701.04		7,022.62	29,723.66	29,697.65
Meetings and Program	6,776.22		6,153.55	12,929.77	11,612.10
Professional Divisions	4,778.66		6,153.56	10,932.22	9,624.96
Admissions			8,380.47	8,380.47	7,669.02
Employment Service	2,631.09			2,631.09	2,643.24
Student Branches	9,909.33	$ 6,253.24	4,990.21	21,152.78	19,801.52
Technical Committee	1,000.00		20,336.31	21,336.31	20,382.64
MECHANICAL ENGINEERING Text Pages		27,071.73	8,999.33	36,071.06	37,255.98
Transactions and *Journal of Applied Mechanics*	126.92	35,369.47	12,904.57	48,400.96	41,574.15
Membership List		5,000.00	1,091.00	6,091.00	10,425.53
MECHANICAL ENGINEERING Advertising Pages		21,963.04	26,659.76	48,622.80	41,068.63
A.S.M.E. Mechanical Catalog		22,300.00	20,138.56	42,438.56	38,588.64
Publications for Sale		41,349.15	9,373.41	50,722.56	35,109.09
Retirement Fund	22,700.00			22,700.00	2,700.00
Parker Case					102.20
Professional Services	1,123.50			1,123.50	1,098.50
Membership Development	2,500.00			2,500.00	2,500.00
Organization Charts	50.00			50.00	33.01
Biographical Data—Membership					1,350.00
Secretary's Office			16,374.30	16,374.30	17,125.82
Accounting			14,680.19	14,680.19	13,702.82
General Service			27,348.26	27,348.26	25,000.47
General Office Expense			20,921.04	20,921.04	17,345.87
TOTALS	$94,280.08	$159,306.63	$212,014.07	$465,600.78	$413,113.56

How the A.S.M.E. Spent Its Income in 1940-1941

EXHIBIT E

Dues Income: $230,038.86—$14.64 per Member.

The principal item of income is the dues paid by the members. Juniors pay $10, $15, or $20 depending upon their age; Members pay $20, Fellows, $25, except that those who have been on the rolls of the Society for 35 years or who have reached 70 and have been members 30 years are carried without dues. On September 30 the Society had 15,714 members on its rolls and during the year $230,038.86 was collected in dues. The per-member dues income is therefore $14.64.

The publications of the Society are Mechanical Engineering, Transactions, including the *Journal of Applied Mechanics*, the Membership List, and the A.S.M.E. Mechanical Catalog and Directory. Income is obtained from advertising in Mechanical Engineering and in the Catalog. Contributions have been received for the *Journal of Applied Mechanics*. An income and expense statement for the publications appears below:

Publications

	Direct expense	Income
Mechanical Engineering	$ 84,693.86	$ 90,741.69[a]
Transactions (including *Journal of Applied Mechanics*) and (Membership List)	54,491.96	1,200.00
A.S.M.E. Mechanical Catalog	42,438.56	47,730.00
Publications sold	50,722.56	80,510.02
	$232,346.94	$220,181.71
Indirect expense	42,438.78	
	$274,785.72	
Less income	220,181.71	
Net cost of publications	$ 54,604.01	
Total expense of publications per member	17.49	
Publications income per member	14.01	
Net expense per member	$ 3.48	

Technical Committee Work: Net Expense $25,800.22—$1.64 per Member.

The Society has nearly two hundred technical committees engaged in the work on research, establishing power test codes, preparing the boiler code, and in preparing standards and safety codes. The work of these committees is supported by direct staff expense which in 1940–1941 was $21,336.31. Adding to it indirect general expense of $4,463.91 gives a total expense of $25,800.22, which on a per-member basis is $1.64. The principal output of the technical committees is publications which are sold to members and to others. This figure of expense should therefore be considered in relation to the publication expense of the Society.

General Society Activities: Net Expense $78,628.06—$5.00 per Member.

The general activities of the Society include the holding of meetings, the operation of Local Sections, Professional Divisions, Student Branches, the administration of the procedure for admitting members to the Society, and the bestowal of awards. The Society receives income from Students for their membership in the Society. The following tabulation shows the net expense for this activity.

General Society Activity Expenses

	Direct expense	Income
Society Meetings	$ 12,929.77	$ 426.00
Local Sections	29,723.66	
Professional Divisions	10,932.22	
Student Branches	21,152.78	21,088.00
Admissions	8,380.47	
Awards	1,072.18	
	$ 84,191.08	$21,514.00
Indirect expense	15,950.98	
	$100,142.06	
Less income	21,514.00	
Net cost of general Society activities	$ 78,628.06	
Total expense of general Society activities per member	$ 6.37	
Income per member	1.37	
Net expense per member	$ 5.00	

Joint Activities: Net Expense $24,434.80—$1.55 per Member.

The Society also participates in a number of joint activities such as the Library, American Engineering Council, Engineers' Council for Professional Development, and the joint Employment Service. In addition to the payments to these joint bodies for these purposes a certain amount of general expense is allocated to these activities. The following tabulation gives the total of this expense.

Joint Activities	Direct expense
Engineers' Council for Professional Development	$ 2,045.01
Engineering Societies Library	9,265.40
American Engineering Council	2,075.00
Employment Service	2,631.09
	$16,016.50
Indirect expense	8,418.30
Total cost of joint activities	$24,434.80
Expense per member	$ 1.55

Administrative: Net Expense $27,215.71—$1.73 per Member.

In carrying out the Society activities certain administrative services must be provided. These include the expense of the Council, the nominating committee, and the provision for auditing, legal, and other services. Certain general income is received. The following tabulation shows the amount of this expense and income.

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[a] No allowance is included for what might be considered as A.S.M.E. member subscriptions to Mechanical Engineering or Transactions. The net expense of $3.48 may be regarded as the amount of these subscriptions.

GENERAL SOCIETY ADMINISTRATION

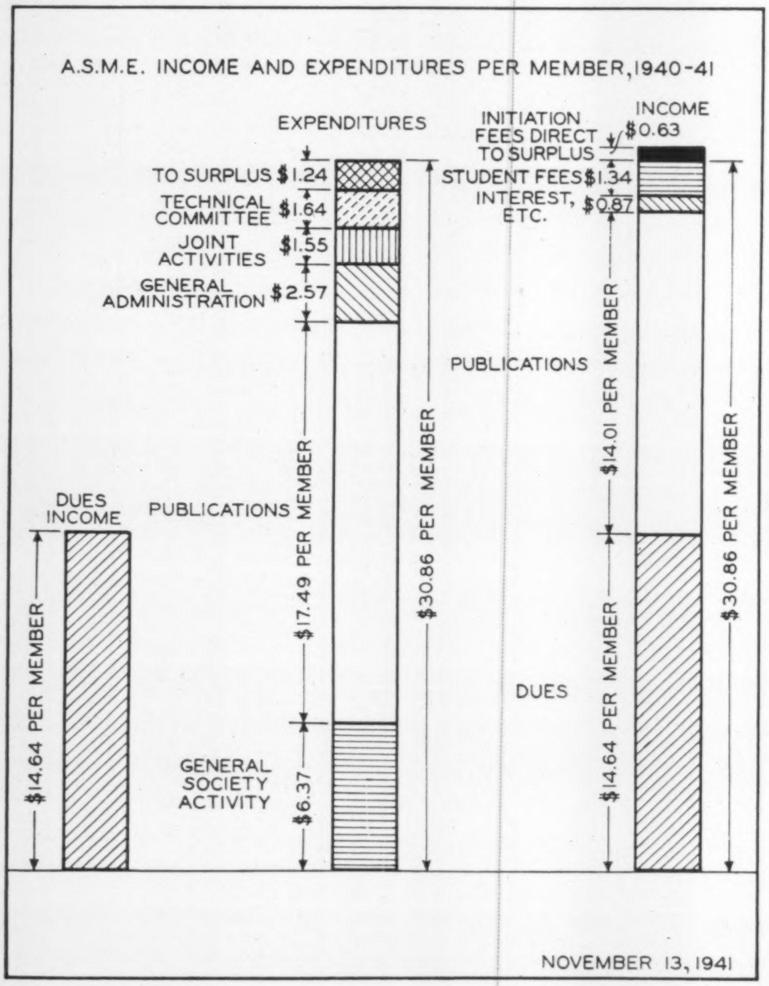
	Direct expense
Council	$ 5,203.84
Nominating Committee	698.82
Retirement Fund	22,700.00
Professional Services	1,123.50
Finance Committee	110.00
Membership Development	2,500.00
Organization Charts	50.00
	$32,386.16
Indirect expense	8,051.82
	$40,437.98
Income from interest and miscellaneous	13,222.27
Net cost of general Society administration	$27,215.71
Expense per member	$ 2.57
Income per member	.84
Net expense per member	$ 1.73

RECAPITULATION

	Expense	Income
Dues	$	$230,038.86
Publications	274,785.72	220,181.71
General Society Activity	100,142.06	21,514.00
Technical Committee Work	25,800.22	....
General Society Administration	40,437.98	13,222.27
Joint Activity	24,434.80	....
	$465,600.78	$484,956.84
Addition to surplus from operating income	19,356.06	
	$484,956.84	

INCOME AND EXPENSE PER MEMBER

	Expense per member	Income per member	Net expense per member
Dues	..	$14.64	..
Publications	$17.49	14.01	$3.48
Technical Committee	1.64	..	1.64
General Society Activity	6.37	1.37	5.00
Joint Activities	1.55	..	1.55
General Society Administration	2.57	.84	1.73
	$29.62	$30.86	
Addition to surplus from operating income	1.24		
	$30.86		



1941 A.S.M.E. ANNUAL MEETING

Mechanical-Engineering Contributions to National Defense and Greater Society Effectiveness Through Local and Technical Programs Are Features of Papers and Discussions

ON THE eve of the formal entry of the United States into World War II, The American Society of Mechanical Engineers, at its 1941 Annual Meeting, held at the Hotel Astor, New York, N. Y., Dec. 1 to 5, directed public attention to national defense in the many sectors of engineering that make up its particular field. With an official registration in excess of 2800, the meeting featured 106 papers delivered at 43 sessions, numerous luncheons and dinners, committee meetings by the score, excursions to near-by plants, and an Annual Dinner that so taxed the facilities of the Astor Ball Room that latecomers had to be turned away.

Although the normal progress of the technical phases of mechanical engineering received adequate attention in papers and discussions and in the deliberations of committees, the dominant note was that of national defense, sounded so strongly a year ago at the 1940 Annual Meeting. A series of meetings and committee activities that have intervened since the 1940 Meeting have marked the increasing emphasis placed by the Society on this vital phase of national life. Nor was the suggestion advanced by W. L. Batt at the 1940 Annual Dinner relating to postemergency planning neglected, for much was heard of it and of the conditions with which it is concerned.

In so far as the Society itself is concerned, most significant of the developments brought out at the Meeting were the improvements in its financial condition, its membership growth, the stepping-up of programs of the professional divisions, and the efforts being made to bring more closely together the professional divisions, which provide the technical programs of the Society's national meetings, and the local sections, which are the first-line contact of a majority of members with the national organization. The mutual benefits that derive from close association of these two great groups to which all members belong—to the one because of the nature of their professional-engineering work and technical interests and the other because they reside or work in a given community—seem to be more generally recognized. Greater cooperation between these groups is earnestly desired by each and means are being developed toward this end.

The scene of the 1941 Annual Meeting, once more the Hotel Astor, was vastly improved this year as a result of the experiences of 1940. Registration was on the tenth floor of the hotel which was given over to the Society's activities for the entire meeting. Ample space was provided for registration, for information headquarters, and for numerous staff attendants assigned to departments of the Society's work in which members have greatest interest. Enough space remained for the informal gatherings of small groups to sit around, talk, and renew old friendships. Although some members still voiced dissatisfaction with removal of the meeting from the Engineering Societies Building, members in general appeared to find the arrangements to their liking. With meeting rooms on the tenth and eighth floors augmented by others on the ground floor and in the basement, and with the almost limitless capacity of the hotel for luncheons, dinners, and committee meetings, practically every situation was met without having to go outside the hotel.

GENERAL PLAN OF PROGRAM

The general plan of the program called for meetings devoted to Society affairs—the Council, the Group Delegates Conference, the Professional Divisions Conference—on Sunday and Monday. The technical sessions began on Monday evening, after the principal business of these official groups had been accomplished, and closed on Thursday evening. "College reunions" were generally scheduled for Thursday evening, and Friday saw the concluding session of the 1940-1941 Council with President Hanley in the chair and the opening session of the 1941-1942 Council under President Parker's chairmanship.

I—TECHNICAL SESSIONS OF DIVISIONS AND COMMITTEES

No attempt is made in this report to cover the technical sessions or the discussions provoked by the reading of technical papers. Many of the papers were available in preprint form. A few have already been published in MECHANICAL ENGINEERING in which some others will appear later. Papers approved for publication in Transactions and the *Journal of Applied Mechanics* will appear throughout the coming year as quickly as discussion can be prepared. Many of the public addresses delivered during the 1941 Annual Meeting will be found in this issue.

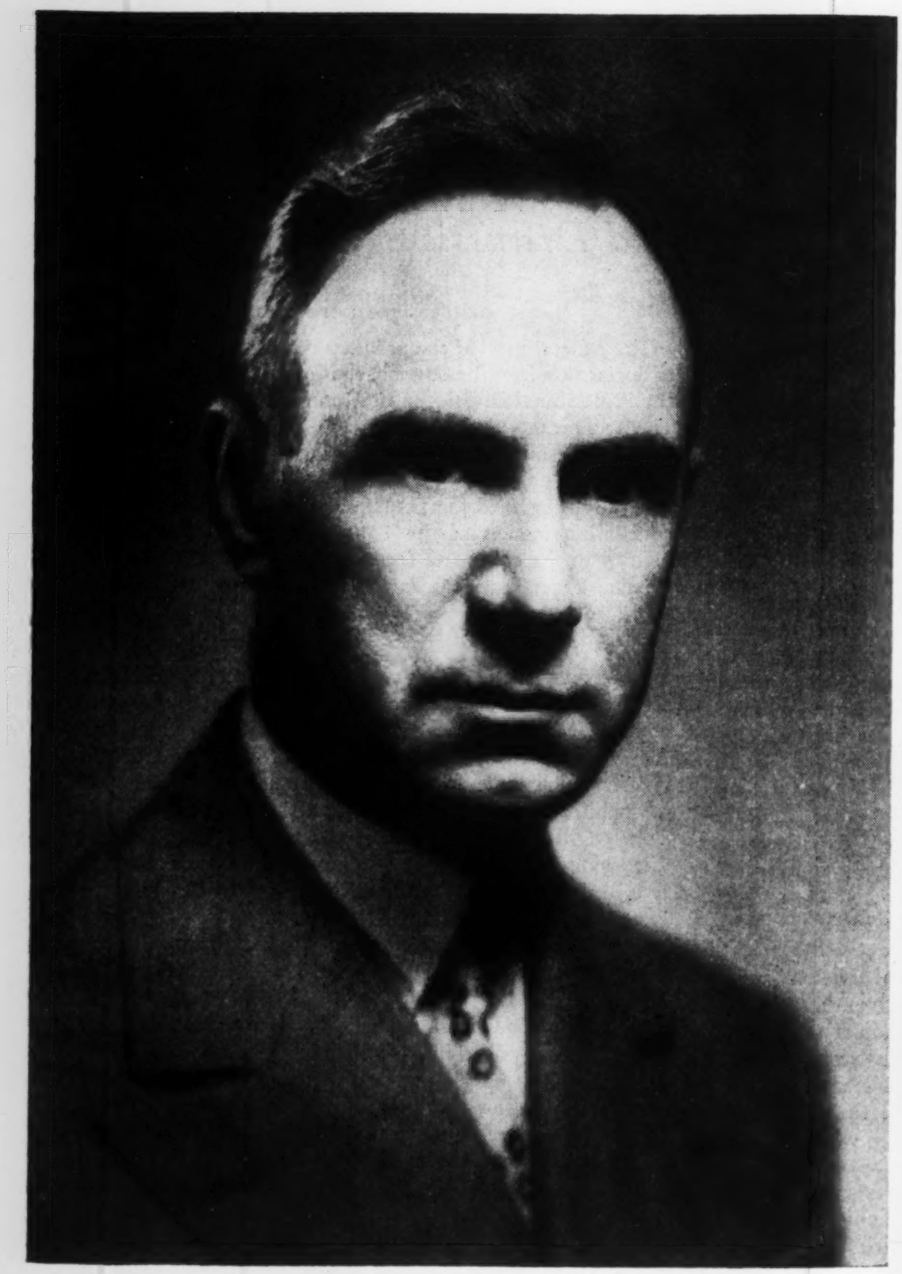
The following brief résumé of the technical sessions summarizes the activities of the professional divisions and Society committees:

The Aviation Division held five sessions: Vibration (four papers); Analysis of Thin-Walled Structures (jointly with the Aviation Division, with five papers); Mechanical Properties of Materials (four papers); Plasticity (three papers); and Fluid Mechanics (three papers).

The Management Division conducted a session on work standardization with three papers; one on mathematical statistics with two papers; a panel discussion on Problems of Management in the Aeronautic Industry (jointly with the Aviation Division) in which representatives of many companies in this field took part; a panel discussion on the question "What Is Top Management Actually Doing About the Supervisory Problem?" and one on Industrial Marketing at which two papers were read.

The Fuels Division, which recently held a joint meeting with the American Institute of Mining and Metallurgical Engineers, sponsored a session with two papers on pulverized fuel and cooperated with the Research Committee, and the Power and Heat Transfer divisions in two other sessions at which a single paper in five major sections was presented.

The Power Division cooperated with the National District Heating Association in one session; with the Hydraulic Division in a second; with the Aviation and Hydraulic divisions in a third; presented two papers on the mercury-vapor process in a fourth session at which R. C. Muir, vice-president, General Electric Company, paid a brief tribute to the late W. LeR. Emmet, originator of the mercury-vapor process. In a fifth session it presented papers on the flow of water-vapor mixtures and wind-tunnel experiments on stacks. It further cooperated



William A. Hanley

Retiring President of
The American Society
of
Mechanical Engineers

with the Research Committee, the Fuels, and Heat Transfer divisions in two sessions at which one paper in five sections, dealing with furnace heat transfer, was read, and with the Society of Naval Architects and Marine Engineers in a symposium of five papers on the Electric Drive of Ships.

The Machine Shop Practice Division held two sessions, one on Machine Design, with two papers, and the other on Defense Production, also with two papers.

The Metals Engineering Division sponsored two papers at a single session.

The Process Industries Division, through its Committee on Industrial Instruments and Regulators, conducted a session on industrial instruments at which two papers were read. Through its Committee on Rubber and Plastics it sponsored two sessions with four papers on subjects within the field of this committee, and through its Committee on Sugar an additional session on sugar.

In addition to the paper previously mentioned in connection with the Power and Fuels divisions, the Heat Transfer Division held a session on Heat Transfer at which two papers were read.

The Hydraulic Division cooperated with the Power Division in two sessions at which three papers were read and conducted two sessions of its own at which five papers were presented.

The Textile Division held one session and a luncheon.

The Aviation Division, as already noted, cooperated with the Applied Mechanics Division in a session on the analysis of thin-walled structures; with the Management Division in a panel discussion; and with the Power and Hydraulic divisions in another session.

The Railroad Division held two sessions and a luncheon. At the morning session there was a symposium on "How Can Mechanical Engineers Assit the Railroads in Meeting the Transportation Phases of the National Emergency?" with

James W. Parker

President of The American Society of Mechanical Engineers for 1942

papers by Messrs. C. D. Young and W. C. Dickerman published in this issue. At the afternoon session the discussion of this subject was continued under the leadership of Ralph Budd. A report of this discussion will appear in a later issue.

The Materials Handling Division presented a single paper on industrial haulage.

The Joint Research Committee on Boiler Feedwater Studies held two sessions devoted to a Symposium on Caustic Embrittlement.

The Research Committee on Lubrication conducted a three-paper symposium on Thermal Conditions in Bearings.

The Committee on Education and Training for the Industries held three sessions at which six papers were read and a film, "Motion Picture Studies of New Tools for Instruction in National Defense," was shown.

The Research Committee on Cutting of Metals held a single session.

NATIONAL DEFENSE

A special session on National Defense at which President Hanley presided was held on Wednesday morning for the presentation of four prepared papers and an extemporaneous discussion. The four prepared papers, which will be found elsewhere in this issue, were as follows: "Research for Defense," by Frank B. Jewett; "Designing for Defense," by Brig. Gen. G. M. Barnes; "Invention for Defense," by Col. L. B. Lent; and "Education for Defense," by A. A. Potter. The extemporaneous discussion by James C. Zeder, of the Chrysler Corporation, has not been made available for publication.

DEFENSE CLINIC

Under the chairmanship of R. M. Gates, president, Air Preheater Corporation, New York, a special Committee on Conservation and Reclamation of Materials in Industry conducted a novel and highly successful session on Tuesday eve-

AT A CLINIC ON THE CONSERVATION AND RECLAMATION OF MATERIALS

(Seated, left to right, F. J. Allen, product engineer, York Ice Machinery Corporation; W. L. H. Doyle, research engineer, Caterpillar Tractor Co.; Harvey N. Davis, president of Stevens Institute of Technology, presiding; Philip D. Reed, chairman of the board, of the General Electric Co., interlocutor; standing, Robert M. Gates, president, Air Preheater Corporation, left, and L. C. Morrow, editor, *Factory Management and Maintenance* right, who arranged the clinic.)

ning. Harvey N. Davis, president of Stevens Institute and a member of the special committee, presided. The session consisted of the presentation of four "case histories" and a clinic on conservation and reclamation. The four case histories were as follows:

Case I—How a large company reclaims and utilizes "scrap" materials, W. W. Finlay, manager, Cincinnati Division, Wright Aeronautical Corporation.

Case II—How a small company does the job outlined in Case I, W. L. H. Doyle, engineer, Caterpillar Tractor Company.

Case III—How a large company conserves materials by means of redesign, substitution, simplification, and standardization, D. R. Kellogg, assistant to manager, engineering laboratories and standards, Westinghouse Electric and Manufacturing Company.

Case IV—How a small company does the job outlined in Case III, F. J. Allen, product engineer, York Ice Machinery Corporation.

Elsewhere in this issue will be found the texts of these four brief papers.

Following the presentation of these papers which had been arranged to set the background for the clinic, Dr. Davis introduced Philip D. Reed, chairman of the board, General Electric Company, who asked a series of prepared questions of a "panel of experts" consisting of the following:

F. J. Allen, product engineer, York Ice Machinery Corporation, York, Pa.

W. L. H. Doyle, research engineer, Caterpillar Tractor Co., Peoria, Ill.

W. F. Drysdale, director general of industrial planning and engineering, Department of Munitions and Supply, Canadian Government, Ottawa.

W. W. Finlay, manager, Cincinnati Division, Wright Aeronautical Corporation, Cincinnati, Ohio.

D R. Kellogg, assistant to manager, engineering laboratories and standards, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

John C. Parker, vice-president, Consolidated Edison Co. of New York, Inc., New York, N. Y.

C. E. Smith, vice-president, N.Y.,N.H.&H.R.R. Co., New Haven, Conn.

W. A. Straw, superintendent of development, Western Electric Co., Inc., Hawthorne, Ill.

The questions and answers, which have not yet been made available for publication, aroused great interest and covered a wide field of experience. In preparation for the Clinic about 10,000 cards were mailed to A.S.M.E. members asking for questions to be put to the experts. Only a very few questions could be addressed to the panel and answered in the time available. The purpose of stimulating interest in the vital subjects of conservation and reclamation was served and many suggestions as to the manner in which clinics of this nature can be carried out in other sections of the country were received. Decision on future development of the clinic idea is awaiting a careful assessment of interest, value, and course of procedure.

II—SOCIETY AFFAIRS

It is customary for the Council of The American Society of Mechanical Engineers to spend Sunday evening of the Annual Meeting with the members of standing and special committees and the group delegates. Starting with a supper at the Engineers' Club this informal gathering lasts as long as anyone has something to contribute to discussion of Society affairs. It is a revealing and educational experience for everyone concerned. Skeletons are dragged out of closets and dusted off. Embarrassing questions are discussed with frankness and answered if possible. On no occasion within memory has heat been substituted for light; and it has been demonstrated time and again that engineers can take it as well as give it. But the significant feature of this informal session is its constructive and educational effect on those in attendance. Coming as it does at the beginning of a long week in which Society policies and programs are set up, this annual event affords a basis for orienta-

EXPERTS WHO ANSWERED QUESTIONS AT A CLINIC ON THE CONSERVATION AND RECLAMATION OF MATERIALS IN INDUSTRY

(Left to right, seated: W. F. Drysdale, director general of industrial planning and engineering, Canadian Department of Munitions and Supplies; W. A. Straw, superintendent of development, Western Electric Co., Inc.; C. E. Smith, vice-president, New York, New Haven and Hartford R.R. Co.; standing, D. R. Kellogg, assistant to manager, engineering laboratories and standards, Westinghouse Electric & Manufacturing Co.; and W. W Finlay, manager, Cincinnati Division, Wright Aeronautical Corporation.)

tion of ideas and a behind-the-scenes experience for old timers and novices alike. The warmth of understanding that comes from informal discussion and explanations freely and frankly given humanizes relationships that otherwise easily become distant and more formal in a nation-wide organization with few opportunities for close personal contacts.

The tone of friendliness and informality is set at the start by the rapid-fire introductions of everyone present by the Society's secretary, C. E. Davies, who has earned for himself the reputation of always being able to personalize every man in the room by stating his name and connection without hesitation or prompting. Then come the questions and the fat is in the fire until a late hour when the incoming president briefly unburdens his mind.

At the 1941 supper President Hanley gave a brief report on his year's activities. There had been a gratifying increase in membership. The National Defense Committee, cooperating with other agencies, had conducted a series of helpful and successful meetings. Roughly $50,000 had been added to the surplus against less prosperous times. He personally had traveled 27,000 miles in fourteen weeks and had spoken to 56 groups. He wanted to hear criticism of the Society and its work so that the Society could be made stronger and render more effective service to the government. Members might differ as to method, he concluded, but not as to objective.

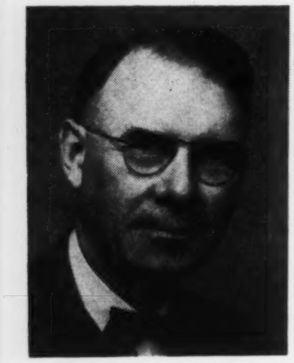
H. H. Snelling started the ball rolling by asking a leading question about service on professional divisions. This led to explanations and comments on the personnel of professional-division executive committees and to suggestions, actively advanced by some groups, of establishing a grade of associate in order to enlist the interest and support of men not generally eligible for full membership but possessed of special interests in the fields of some of the divisions and sections. The advantages and disadvantages of the proposal were thoroughly aired by many speakers, and schemes adopted by certain divisions and sections for dealing with the situation were described. The point was effectively made by E. G. Bailey that selection of members for executive committees was one of the most important tasks confronting the groups responsible for the successful continuance of the work of the divisions and technical committees. He advised appointment of a stronger man than the retiring member of any committee as a method of insuring progress. Committees should, he said, "prayerfully and honestly go after the better man."

This led to a discussion, initiated by H. L. Eggleston, chairman of the Committee on Local Sections, of closer cooperation between the divisions and sections. Numerous examples were cited. Mr. Eggleston made a point of the need for establishing a "single-valued" appeal to local-section members based on their bread-and-butter interests. Means to this end would differ according to the size and location of the section. Specific cases and problems were described by several speakers.

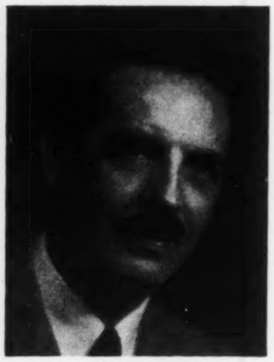
Major Wichum, chairman of the Committee on Professional Divisions, ably seconded by William M. Sheehan and E. E. Aldrin, discussed the appeal to the Council for additional funds to provide staff and money to bolster up the work of some of the divisions. Reference to the Aviation Division was specifically made as an illustration of the opportunity facing the Society in serving a large and rapidly growing industry and A.S.M.E. members working in it.

Dean Sackett put in a word for the junior member and his needs and interests. The Society was concerned about the junior, he said, and the junior should be concerned about the Society. Local sections were conscious of their responsibility where the junior was concerned and were putting him to work.

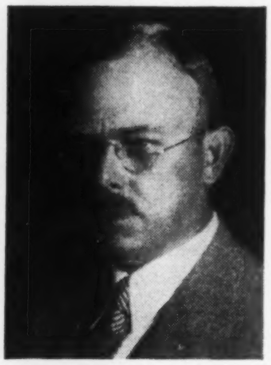
Past-President McBryde called attention to the article by W. F. Durand on the Aims and Objects of A.S.M.E. that appeared in the September issue of MECHANICAL ENGINEERING. He spoke of his contacts with the Washington Section which had been addressed by H. H. Snelling on this same subject. The Society, he said, was facing changing conditions and the Annual Meeting afforded an opportunity to discuss their effect.



C. B. PECK

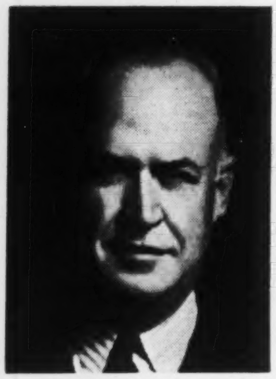


W. R. WOOLRICH

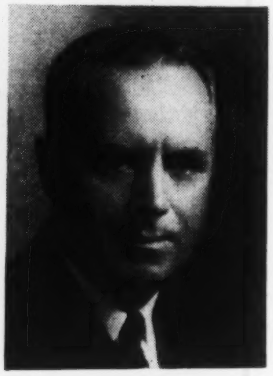


C. F. FREEMAN

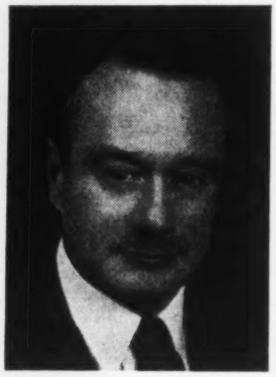
Vice-Presidents



W. G. CHRISTY



H. L. EGGLESTON



T. S. MCEWAN

Managers

New Members of 1942 A.S.M.E. Council

In closing the session J. W. Parker, president-elect, said that it was clearly realized that the Society's committees carried the load; it was the Council's function to steer the committee and keep its thinking clear. The Council delegated some of its authority to its Executive Committee which met monthly, and to the officers and secretary. All were sensitive to members' thinking. It would be his responsibility to sound out this thinking of members and of the Council in advance of proposed actions.

THE 1941 ANNUAL BUSINESS MEETING

The 1941 Annual Business Meeting of The American Society of Mechanical Engineers was held at the Hotel Astor on Monday noon immediately following a luncheon of the Council, the group delegates, professional divisions, and chairmen of standing committees. President Hanley was in the chair.

C. E. Davies, secretary of the Society, presented the Report of the Council which, with the Finance Report, is published in this issue, and called attention to the reports of committees to the Council, copies of which are available on request.

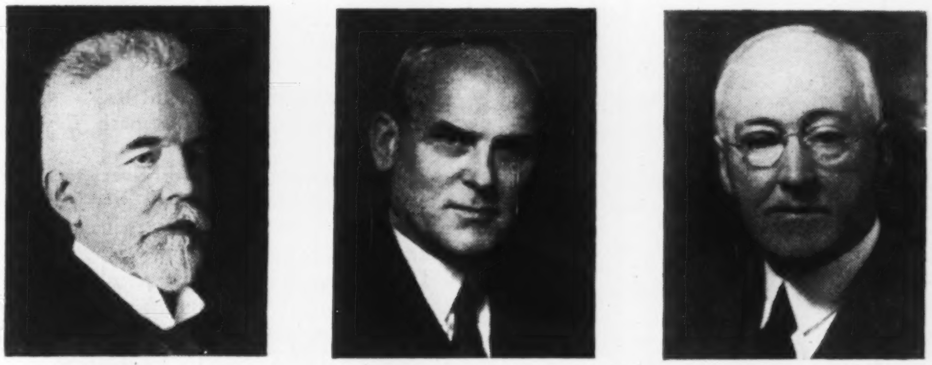
After he had outlined the major points of the Finance Report, J. L. Kopf, chairman of the Finance Committee, gave an inspiring exposition of what was back of the "dancing figures" that constituted the various financial statements. Asserting that a financial statement was no real indication of the condition of the Society, Mr. Kopf called attention to its student and junior members, its local sections, its professional divisions, publications, and Council; to its staff and its officers. So stirring was Mr. Kopf's unusual report that he was greeted as he stepped down with long and prolonged applause.

For the record, Mr. Davies called attention to the Society's list of property owned and its transactions during the year in securities. Also for the record he introduced a list of members elected during the year. A motion to approve the reports was carried.

Mr. Davies then called for a report of the tellers of the election of a Nominating Committee for 1942, which was presented by Herbert L. Eggleston, chairman of the Committee on Local Sections, who explained the procedure followed in selecting the members of the committee. He then announced the membership of the Nominating Committee for 1942 as follows:

H. W. Smith, chairman
T. E. Bell, secretary

I E. S. Dennison, Groton, Conn.
J. E. Lovely, Springfield, Vt., first alternate
M. D. Engle, Boston, Mass., second alternate
II Waldo McC. McKee, New York, N. Y.
III F. C. Stewart, State College, Pa.
F. A. Allner, Baltimore, Md., alternate
IV T. E. Bell, Atlanta, Ga., secretary
James Ellis, Kingsport, Tenn., first alternate
A. M. Ormond, Savannah, Ga., second alternate
V H. W. Smith, Ellwood City, Pa., chairman
Max W. Benjamin, Dearborn, Mich., first alternate
M. R. Bowerman, Homeworth, Ohio, second alternate



AUREL STODOLA CLARENCE DECATUR HOWE LEON PRATT ALFORD

REAR ADMIRAL SAMUEL MURRAY ROBINSON MAJOR GENERAL CHARLES MACON WESSON

Made Honorary Members of the A.S.M.E.

VI O. F. Campbell, East Chicago, Ind.
  L. H. Stark, Milwaukee, Wis., first alternate
  C. A. Jacobson, Beloit, Wis., second alternate
  M. P. Cleghorn, Ames, Iowa, third alternate
VII Julius Billeter, Salt Lake City, Utah
  W. J. Cope, Salt Lake City, Utah, alternate
VIII E. C. Baker, Stillwater, Okla.
  A. L. Hill, Denver, Colo., first alternate
  C. E. Brown, Kansas City, Mo., second alternate.

Upon motion the committee as announced by Mr. Eggleston was declared elected.

An unusual feature of the 1941 Annual Business Meeting was an address delivered at the request of the Council by Robert E. Doherty, chairman of the Engineers' Council for Professional Development. The address appears in full in this issue. Mr. Doherty replied to questions from the floor, by E. S. Smith, A. M. Selvey, Jr., Frank H. Prouty, A. A. Potter, and R. L. Sackett.

W. M. Sheehan moved the vote of thanks to Mr. Doherty.

Mr. Davies spoke of the work of the A.S.M.E. Boiler Code Committee and paid tribute to its retiring chairman, D. S. Jacobus, past-president A.S.M.E. Dr. Jacobus responded and introduced E. R. Fish, newly elected chairman.

Following some comment on the Hotel Astor as a meeting place for the Society's Annual Meetings it was moved that the 1942 Annual Meeting be held at the Engineering Societies Building. The motion failed to pass.

BINGER ON LESSONS LEARNED FROM LONDON

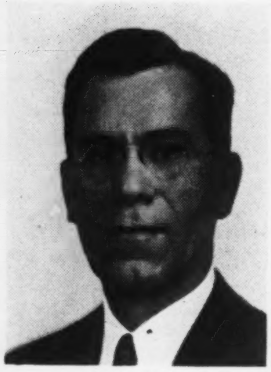
At a crowded National Defense luncheon held on Tuesday noon, Walter D. Binger, Commissioner of Borough Works, Office of Borough President of Manhattan, New York, N. Y., and chairman, National Technological Civil Protection Committee appointed by the Secretary of War, spoke on "Lessons Learned From London."

W. A. Hanley, president A.S.M.E., presided at the luncheon and introduced a number of distinguished persons seated at the speakers' table. He also presented to G. Walker Gilmer, 3rd, University of Florida, of the Pan American Airways, Inc., the Undergraduate Student Award for his paper "Center of Pressure Characteristics of a Marconi Yacht Sail." The award was to have been presented at the luncheon on Wednesday, but Mr. Hanley explained that by the time that luncheon would be held Mr. Gilmer would be flying across the ocean to take up new duties outside the United States.

Commissioner Binger was introduced by Col. James L. Walsh, chairman of the A.S.M.E. Committee on National Defense and member of National Technological Civil Protection Committee. Mr. Binger, who spoke extemporaneously, told of a trip he had made to England in the fall for the purpose of securing firsthand information on the damage done by enemy action and methods of protection and repair. He had had an entire year to prepare for this trip, during which time he had digested all the public, private, and confidential information that had reached this country. He had full cooperation of both governments, he said, but his task was greatly eased by the assistance extended to him by the British engineering societies who were best qualified to tell him where to find the technical information he most desired. He had made up some 200 questions, before leaving this country, from queries turned over to him by technical groups and others. They related to the effects of gas, the blackout, railroads, utilities, power, and other services.

Mr. Binger cited many examples to show how valuable it

THEODOR VON KÁRMÁN



JOHN C. GARAND

(Dr. von Kármán of the California Institute of Technology received the A.S.M.E. Medal for his brilliance as a teacher, his researches in elasticity, and many fields of physics and mechanics and his distinguished leadership in the fields of aerodynamics and aircraft design. Mr. Garand was awarded the Holley Medal for his invention and development of the semiautomatic rifle which has been adopted by the United States Army—a distinct contribution to our national defense.)

had been to study British experience at first hand so that comparisons could be made between conditions there and in this country. For example, it had been assumed that brick was a superior material for bomb shelters because so much had been used in England. He discovered that a shortage of form lumber was the chief reason for using brick rather than concrete. Numerous cross connections of London's ancient water-supply system had demonstrated their usefulness in maintaining service interrupted by bombing.

Observations on bombs and damage caused by them proved particularly interesting to the audience, as did reports of the rapidity with which interrupted services were re-established and the usual procedure of making permanent rather than temporary repairs. Protective devices for generators in power stations against splinters and the effects of a "near miss" had been effective, he said, in maintaining operation. A 2-inch layer of cork was covered with a shell of concrete with ship-lapped joints so arranged that the generator could be opened up whenever necessary. Overhead transmission lines had proved practically immune to direct hits or damage except for short circuits caused by the balloon barrage. Railway tracks, although badly bombed, had not been out of service longer than 24 hours.

Mr. Binger closed by describing briefly an air-conditioned aircraft-engine factory constructed in an ancient stone quarry 80 to 95 ft below ground and occupying about 30 acres of the 60 acres formerly worked. Here where interruptions from air raids were unknown and the inconveniences of the blackout were forgotten, men worked in a security that relieved their families of fears of danger.

MECHANICAL ENGINEERS HONORED AT ANNUAL DINNER

Bigger and more brilliant, if possible, than ever was the 1941 Annual Dinner of the A.S.M.E. held at the Hotel Astor on Wednesday evening, December 3. Past-President Batt, who acted as toastmaster, announced that more than 1200 persons, many of whom had to be seated in the galleries, were present and that many had been turned away because of lack of space.

As soon as service of the dinner was completed, Mr. Batt introduced the distinguished persons who were seated at the two speakers' tables that extended along the east side of the Astor ballroom. He read the list of the 1941 "Fifty-year members of the A.S.M.E." and presented the fifty-year buttons to those who were present. The 1941 list is as follows:

Frederic C. Billings, George M. Brill, Robert Stanley Brown, Frederic N. Bushnell, Gordon Campbell, Bertrand R. T. Collins, William A. Doble, William W. Estes, John W. Ferguson, J. S. Foster, W. E. Hopton, John Knickerbacker, Judson Lattin, Edw. S. McClelland, Paul B. Morgan, Joseph G. Prosser, Louis E. Reber, Charles H. Repath, Edward P. Robinson, and George I. Rockwood.

The introduction of the fifty-year members was followed by the calling up of other classes, forty-five, forty, and thirty-five, and on all those who had been members for more than fifty years.

Mr. Batt then introduced President Hanley, who presided at the exercises of conferring prizes, awards, and honorary memberships. Candidates for awards were presented by Joseph W. Roe, chairman of the Board of Honors and Awards, and were escorted to the dais individually by a member of the Board. President Hanley handed to each in turn, amid applause, the medals and certificates conferred upon them.

The 1941 Medalists were as follows:

John T. Rettaliata, Junior Award, for his paper "The Combustion Gas Turbine."

R. Hosmer Norris, Pi Tau Sigma Medal, "for outstanding achievement in mechanical engineering, particularly in the heat-transfer field.

Roger V. Terry, Melville Medal, for his paper "Development of the Automatic Adjustable-Blade-Type Propeller Turbine."

Richard Vynne Southwell, Worcester Reed Warner Medal "for his many distinguished services to engineering science through papers and publications in many fields." (Mr. Southwell was not present, but the award was received in his behalf by Dr. Charles G. Darwin, Chief, British Central Scientific Office, Washington.)

Theodor von Kármán, A.S.M.E. Medal, "for his distinguished leadership in the fields of aerodynamics and aircraft design."

John C. Garand, Holley Medal, "for his distinct contribution to our national defense."

Two other medals, in the conferring of which the Society acts jointly with other bodies, were presented in brief ceremonies conducted at opposite ends of the speakers' table by representatives of the boards involved.

Harold V. Coes, for the Gantt Medal Board of Award, introduced Wallace Clark, who presented the Medalist, Paul E. Holden, to whom the Gantt Medal for 1941 was awarded "for outstanding achievement in the application of management principles in industry and business."

RICHARD VYNNE SOUTHWELL

ROGER V. TERRY

(Dr. Southwell of Oxford, England, was awarded the Worcester Reed Warner Medal for his many distinguished services to engineering and science through papers and publications in many fields including aeronautics, theory of structures, elasticity, and hydrodynamics. Mr. Terry received the Melville Medal for his paper "Development of the Automatic Adjustable-Blade-Type Propeller Turbine.")

At the opposite end of the table Scott Turner, chairman of the Hoover Medal Board of Award, introduced Arthur M. Greene, Jr., who presented the 1941 recipient of the medal, D. Robert Yarnall. Mr. Turner made a brief address on the award and displayed the medal and certificate, and Mr. Yarnall responded modestly, accepting the medal on behalf of the Yarnall family.

Taking over the chair again, President Hanley then presented the certificates of honorary membership to the following:

Clarence Decatur Howe, Minister of Munitions and Supplies for Canada.

Charles Macon Wesson, Major General of the United States Army and Chief of Ordnance.

Samuel Murray Robinson, Rear Admiral of the United States Navy and Chief of the Bureau of Ships.

Aurel Stodola, Professor of Mechanical Engineering at the Swiss Technical University in Zurich. (Dr. Victor Nef, Consul General of Switzerland, received the certificate on Dr. Stodola's behalf.)

Leon Pratt Alford, Fellow and Past Vice-President of the A.S.M.E.

Mr. Batt then announced the A.S.M.E. Officers for 1941-1942 and introduced President Hanley, whose address "America Must Decide" appears in this issue.

President-Elect James W. Parker was introduced amid applause and responded briefly, after which Donald M. Nelson, executive director of the Seven Man Supply Priorities and Allocation Board, delivered an address, "Whither Industry—in Democracy's Arsenal," which is printed in this issue.

A Presidents' Reception, with the distinguished guests in the receiving line, followed the dinner while the ballroom was being cleared for dancing.

HANLEY AND PARKER SPEAK AT LUNCHEON

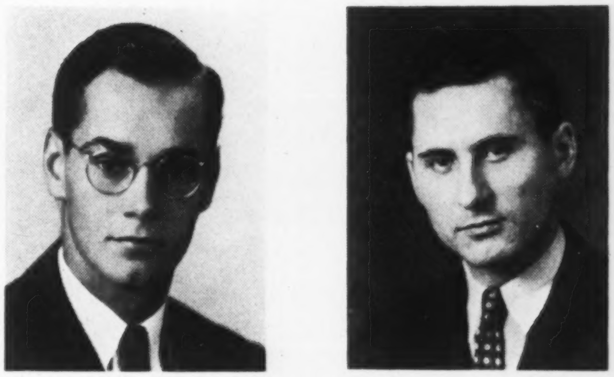
Monday's luncheon, at which the Council met with members of the local sections, professional divisions, group delegates, and standing committees, was presided over by H. L. Eggleston, chairman of the Committee on Local Sections.

In opening the series of brief informal talks that followed the luncheon, Mr. Eggleston said that many persons present had been hard at work at committee and Council assignments for more than a day. The tempo and spirit of these men had impressed him and indicated a growth in vitality that he was sure would last. He then introduced the chairmen of the standing committees present and called upon President Hanley.

The program of the 1941 Annual Meeting, Mr. Hanley said, would mean something to every man who attended the meeting. The Society had a job to do in maintaining high standards and and an even greater job in National Defense. The future, he said, depended on how well we did the job of winning the war and on how well we should be able to handle what was to come. The solution to our problems would not be easy and the transition period would be long. If we were to maintain the ideals of the past and remember our responsibility of carrying out our traditions of seeing to it that young men had the opportunities we had had and if we were to carry out our obligations to our government, we would not be criticized. The war was a job for engineers and planning was a technological task. If we could do our part as a professional group and as individuals, we would have done all that would be expected of us and would not have failed.

R. HOSMER NORRIS JOHN T. RETTALIATA

(Mr. Norris received the Pi Tau Sigma Medal for outstanding achievement in mechanical engineering, particularly in the heat-transfer field. Mr. Rettaliata received the Junior Award for his paper "The Combustion Gas Turbine.")



G. WALKER GILMER, 3RD JOHN J. BALUN

(G. Walker Gilmer, 3rd, received the Undergraduate Student Award for his paper "Center of Pressure Characteristics of a Marconi Yacht Sail." Mr. Balun received the Charles T. Main Award for his paper "The Need and Possibilities of Participation by Engineers in Public Affairs.")

James W. Parker, president-elect, in being called upon to speak, said that his only criticism of the meeting up to this point would be that we might be taking ourselves too seriously. We were facing a serious and difficult job, he admitted, but we should not lose our sense of proportion. After the last war we had marveled at what had been accomplished and as yet we were not aware what our nation was capable of accomplishing. It was the task of the A.S.M.E., he concluded, to go with the stream of human affairs, to guide it, and to carry on in the traditional ways found in the past to be effective. Engineers faced the task of thinking and of bringing people together. The job of the Society was largely an administrative one.

A.S.M.E. COUNCIL MEETS

For members of the A.S.M.E. Council, the 1941 Annual Meeting began on Sunday morning, Dec. 1, when the Executive Committee of the Council met in anticipation of the session of the entire Council in the afternoon. After a luncheon at which several members of standing committees were present, President Hanley called the session to order at 1:30 p.m. at the Hotel Astor. With the exception of three members, the Council was complete. W. L. Batt and J. C. Hunsaker were detained in Washington with official business and W. H. Winterrowd sent word that an automobile accident had placed him in the hospital. No fears were expressed concerning Mr. Winterrowd's rapid recovery, but his death occurred suddenly on the morning of December 7.

The Council first took up the subject of a policy to govern its surplus, and the situation was thoroughly reviewed by J. L. Kopf, chairman of the Finance Committee, and by members of the Council and the Committee. Discussion resulted in a vote

PAUL B. HOLDEN

D. ROBERT YARNALL

(Mr. Holden received the Gantt Medal for outstanding achievement in the application of management principles in industry and business. Dr. Yarnall was awarded the Hoover Medal for outstanding humanitarian activities constituting distinguished public service.)

to build up the Society's surplus to $340,000 during the next five years.

The Secretary then reported certain actions by the Executive Committee relating to a proposed Washington office operated jointly by the Founder Societies. The A.S.C.E., he reported, had appointed a Washington representative. No action was taken.

The Executive Committee had disapproved the pension plan put forward by the United Engineering Trustees and had asked the Finance Committee to confer with the other Founder Societies on this subject.

Excellent handling of the Max Toltz Fund had made it possible to authorize the Committee on Relations With Colleges to loan $1800 to worthy engineering students. Eight hundred dollars in loans had been repaid by former students, it was announced.

Other routine matters were reported for the record.

Mr. Davies also reported that increased income from sales of the Boiler Code had provided funds for employing a staff assistant to act as secretary to the Boiler Code Committee. Dr. T. H. Shields, who will fill this post, had reported for work and would be able to be of help in matters relating to welding and the Petroleum Division, in addition to his major duties.

The Council voted to join with the S.A.E. in petitioning the National Advisory Committee for Aeronautics to name its new engine research laboratory in honor of Charles M. Manly, former member of both societies and builder of the engine used by Langley in his airplanes.

President Hanley then called for reports of the members of the Council who had been assigned to certain districts in order to keep in touch with the local sections and student branches. Messrs. Herron, Davis, Christie, McBryde, Condit, Hodgkinson, Irwin, Earle, Prouty, Ricketts, Freeman, Woolrich, Eshelman, Helander, Shoemaker, Croft, Eaton, Hulse, and Hanley gave gratifying reports of their experiences.

H. L. Eggleston, speaking on behalf of the Local Sections Committee, suggested that the Council members should talk with the leaders of the sections on how their interest in the Society's activities could be enlisted. By drawing on all members of the Society, he predicted, better results would be obtained. He mentioned a number of sections in which, in his opinion, a good job was being done for the members and urged that consideration be given to organizing some of the larger sections along the lines of the professional divisions. This had been done in some sections, he pointed out. He further emphasized the need for setting up a "single-valued" appeal to local-section members with the object of affecting their "bread-and-butter" interests. He called attention to the urgency of the "junior problem" which, he said, would be solved if means were devised for interesting all members of a local section.

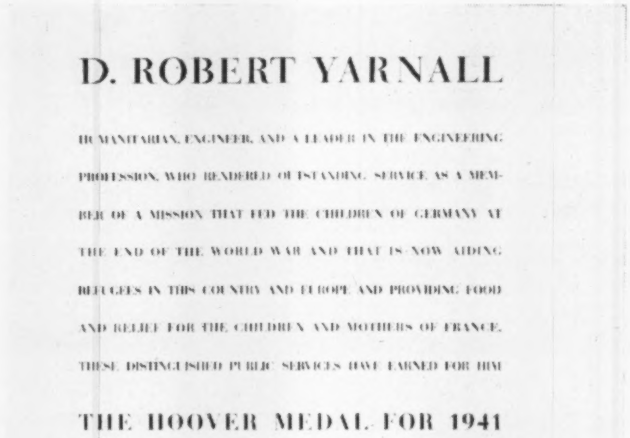
The Secretary presented the report of the Council and the reports of the standing and other committees for 1940-1941 and approval of them was voted. The report of the Woman's Auxiliary was approved.

Changes to the By-Laws B-6-B and B-15 were approved for first reading. Final approval will be asked at the 1942 Semi-Annual Meeting of the Council.

A report of the Subcommittee on Junior Development was summarized, as was a report "A.S.M.E. Should Be Sold to Industry."

For the Board on Technology K. H. Condit, chairman, reported that the membership of the Board had been increased to include a representative of the Committee on Local Sections; H. L. Eggleston was that representative, with J. N. Landis his alternate. On the matter of changing the character of spring and fall national meetings of the Society so as to make them regional in scope but devoted to one or more specific interests, the Board recommended no definite action. Mr. Condit reported that charges for preprints would be levied beginning with the Houston meeting. These charges were in line with those established by the A.I.E.E. and would be the same for members and nonmembers. Announcement of these charges will appear in MECHANICAL ENGINEERING.

A recommendation of the Board to increase the budget of the Committee on Professional Divisions from $2700 to $4000, and to add to the Budget under Office Expense $8000 for staff assistance in the field of the professional divisions was presented and discussed. C. B. Peck and Victor Wichum of the Board spoke in favor of the recommendation and in explanation of the urgency of immediate action. After extended discussion it was



D. ROBERT YARNALL

HUMANITARIAN, ENGINEER, AND A LEADER IN THE ENGINEERING PROFESSION, WHO RENDERED OUTSTANDING SERVICE AS A MEMBER OF A MISSION THAT FED THE CHILDREN OF GERMANY AT THE END OF THE WORLD WAR AND THAT IS NOW AIDING REFUGEES IN THIS COUNTRY AND EUROPE AND PROVIDING FOOD AND RELIEF FOR THE CHILDREN AND MOTHERS OF FRANCE. THESE DISTINGUISHED PUBLIC SERVICES HAVE EARNED FOR HIM

THE HOOVER MEDAL FOR 1941

THE HOOVER MEDAL BOARD OF AWARD

AMERICAN SOCIETY OF CIVIL ENGINEERS
AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

ENOCH R. NEEDLES
RALPH BUDD
CHARLES M. SPOFFORD
JOHN V. W. REYNDERS
SCOTT TURNER
ROBERT C. STANLEY
WILLIAM H. KENERSON
STEPHEN F. VOORHEES
WILLIAM L. BATT
H. H. BARNES, Jr.
WILLIAM McCLELLAN
[illegible]

CHAIRMAN Scott Turner
VICE-CHAIRMAN
SECRETARY C E Davies

CERTIFICATE ACCOMPANYING THE HOOVER MEDAL AWARDED TO D. ROBERT YARNALL voted to refer the recommendation to the Finance Committee for consideration at the time of revising the 1941-1942 Budget and to instruct the Secretary to look for an additional staff member at once and to bring in an estimate of salary and other costs.

Colonel James L. Walsh made an "off-the-record" report on National Defense which was greeted with applause and a rising vote of thanks for his services.

Routine matters relating to office operation, the definition of "mechanical engineer," and Society publicity were reported for the record without action.

Harvey N. Davis presented a resolution prepared by a committee on defense training in the metropolitan area recommending allocation of a portion of the funds being expended on defense training by the Office of Education to full-time undergraduates and to graduate instruction in the engineering colleges. After comments from faculty members of several colleges had been heard the Council voted to approve the resolution in principle and to add the Council's recommendation in support of it to that of the group in which it had originated.

At this point the Council adjourned and reconvened on Friday morning in the rooms of the Society. Mr. Hanley was again in the chair and members of the 1941-1942 Council were present.

The secretary announced that he had received word from W. D. Ennis, treasurer, that an anonymous gift of $1000 had been made to the Society. The donor made no stipulations as to how the gift was to be used. Announcement was also made of a gift of $500 from John Knickerbacker, a member of the Society since 1891. The Council voted to receive these gifts with sincere appreciation.

G. B. Karelitz, for the Committee on Professional Divisions, reported that the Machine Shop Practice Committee had voted to change its name to Production Engineering Division.

On behalf of the Special Committee on Consulting Practice which issued its report during the year, M. X. Wilberding reviewed the experiences of his committee in working with the architects, landscape architects, and civil engineers in matters relating to division of interests and on fees for consulting practice. Although the schedules suggested by the committee had not been accepted, the results had already meant a great deal. Continuation of the committee was recommended. The Council voted that the Committee be encouraged to cooperate with other planning professions so as to assist government agencies in planning work effectively.

COL. J. F. JENKS (RIGHT) ORDNANCE DEPARTMENT, U. S. ARMY, INTRODUCES W. C. KEYS AS MR. KEYS IS ABOUT TO PRESENT HIS PAPER ON RUBBER MOUNTINGS

JOHN C. GARAND BEING PRESENTED THE HOLLEY MEDAL BY PRESIDENT HANLEY

H. B. Oatley, for the Committee on the Economic Status of the Engineer, submitted a report on Unionism in the Profession, a revision of two previous reports which had been referred back to the Committee by the Council. After considerable discussion the Committee was relieved of further consideration of the subject of unionism.

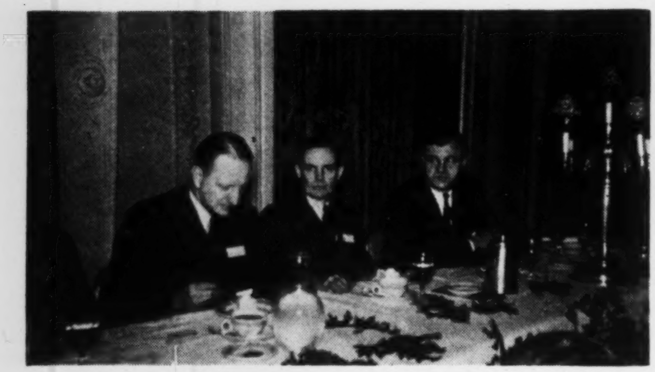
Reporting for the Group Delegates Conference, W. H. Larkin, of New York, summarized the actions of greatest interest. A report of the Conference and summary of its actions will be found in the A.S.M.E. News Section of this issue. The Council voted its appreciation of the work of the delegates as a group and as individuals, and of the services of Mr. Larkin.

Appreciation of five members retiring from active service on the Council was voiced by Past-President H. N. Davis. R. M. Matson reported that Mrs. E. W. Burbank and her children had asked to extend to Mr. Burbank's friends their appreciation of kindnesses and courtesies during the illness that preceded his death.

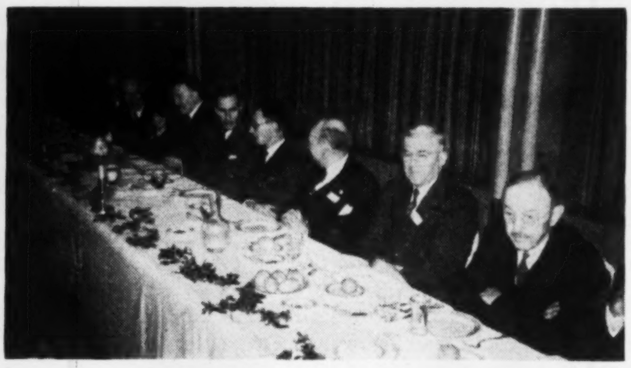
There being no further business to be considered by the 1940-1941 Council, it adjourned, and the 1941-1942 Council was called to order by Mr. Hanley. New members of this Council were introduced and Mr. Parker then took the chair. On the motion of Mr. Shoemaker the thanks of the Council for Mr. Hanley's services in office was voted.

C. E. Davies and W. D. Ennis were re-elected secretary and treasurer, respectively, for the year 1941-1942.

The matter of Society policy on unionism was referred to the Executive Committee.

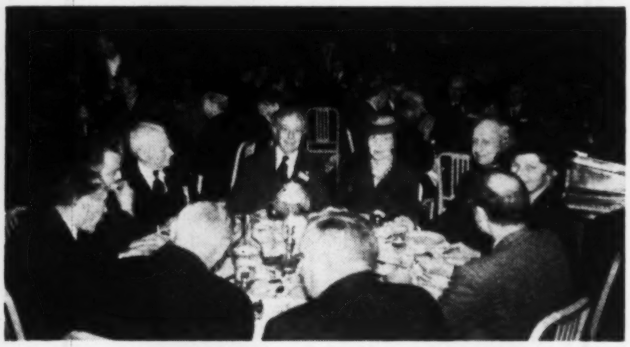


L. AUSTIN WRIGHT, BRIG. GEN. G. M. BARNES, AND C. E. DAVIES



THE SPEAKERS' TABLE, NATIONAL DEFENSE LUNCHEON

THIS AND THE PHOTOGRAPH OPPOSITE SHOW THE AUDIENCE



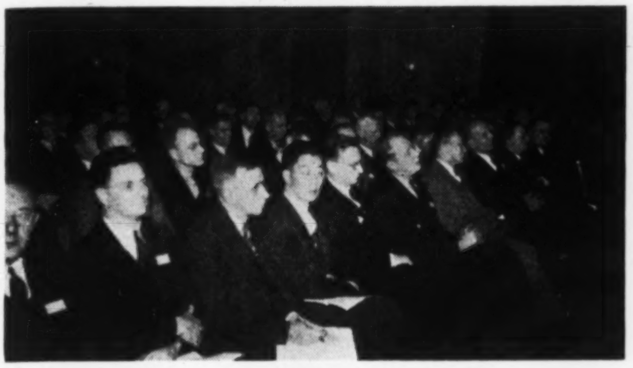
MR. HARTE COOKE IS LOOKING DIRECTLY AT THE CAMERA

MR. AND MRS. H. E. HARRIS, MR. AND MRS. FRANK, L. E. JERMY, AND T. F. GITHENS

J. F. FIRTH-HAND, I.M.E., PRESIDENT HANLEY, AND AURELIO M. BAIDAFF, ARGENTINE ENGINEERING SOCIETY

Taken at National Defense and Student Luncheons, 1941 A.S.M.E. Annual Meeting

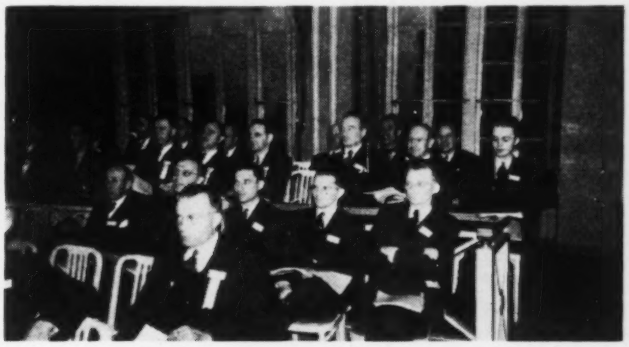
(Left: President Hanley presents the Undergraduate Student Award to G. Walker Gilmer, 3rd, for his paper "Center of Pressure Characteristics of a Marconi Yacht Sail.")



THERE WAS A GOOD TURNOUT AT THE WORKS STANDARDIZATION SESSION MONDAY NIGHT

BERNARD SHEREDD, J. M. JURAN, CHAIRMAN, AND LILLIAN M. GILBRETH, AT WORKS STANDARDIZATION SESSION

AT THE BUSINESS MEETING ON MONDAY AFTERNOON



ANOTHER VIEW OF THE BUSINESS MEETING

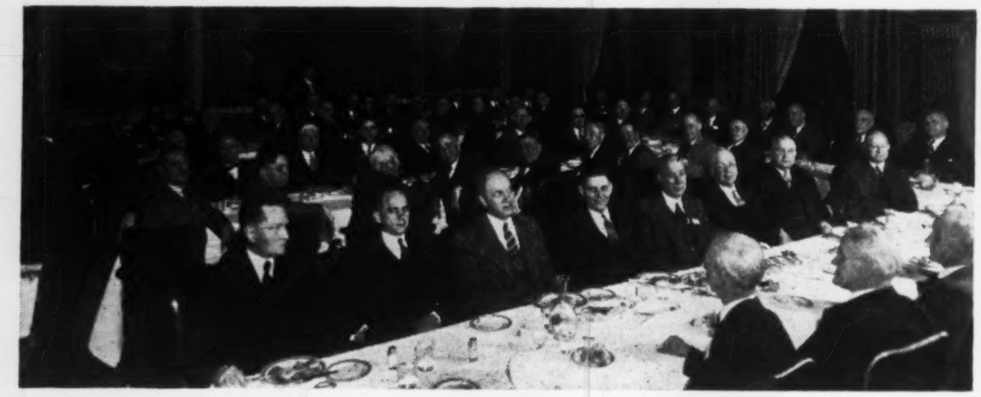
DR. SANFORD A. MOSS (SECOND FRONT LEFT) IS ABOUT TO SPEAK

AT THE POWER SESSION WEDNESDAY AFTERNOON

Taken at Various Sessions Throughout the 1941 A.S.M.E. Annual Meeting

(It is not possible to give names when groups are so large but here and there is a familiar face—and when we know them we tell you.)

WOMEN IN ATTENDANCE AT A NIGHT SESSION



AT THE DINNER FOR DR. JACOBUS

A tribute to the Engineering Societies Personnel Service, Inc., was paid by Past-President McBryde who summarized some of its principal achievements.

The personnel of the Executive Committee for the coming year was announced as follows: James W. Parker, chairman; Clarke Freeman, vice-chairman; C. B. Peck, George E. Hulse, and Thomas S. McEwan, members.

After adjournment of the Council the Executive Committee met for a brief session.

PROFESSIONAL DIVISIONS CONFERENCE

With Victor Wichum, chairman of the Committee on Professional Divisions, in the chair and members of the executive committees of the divisions in attendance, a professional divisions conference was held at the Hotel Astor on Monday afternoon. Plans for coming meetings of the Society were discussed. Mr. Hartford outlined the history of moves in the Society to make available an "affiliate" grade of membership, and the subject was referred to the Council without recommendation. Improvements in procedures in reviewing papers were suggested and cooperation of the divisions with the local sections was discussed briefly. It was pointed out that in selecting men for the executive committees of the divisions care should be exercised to secure "a better man than the one replaced."

III—D. S. JACOBUS HONORED

At a dinner attended by present and former members of the A.S.M.E. Boiler Code Committee, members of the Council of the Society, and guests, Past-President D. S. Jacobus, who has acted as chairman of the Code Committee for many years, and who has recently retired from that post, was honored.

H. B. Oatley, vice-chairman of the Boiler Code Committee, presided at the dinner and introduced A. M. Greene, Jr., member of the Committee since 1916, who reviewed his early impressions of the A.S.M.E. and its distinguished members, his long acquaintanceship with Dr. Jacobus, and the history of the Boiler Code Committee. He then read the following resolution, which was signed by all present.

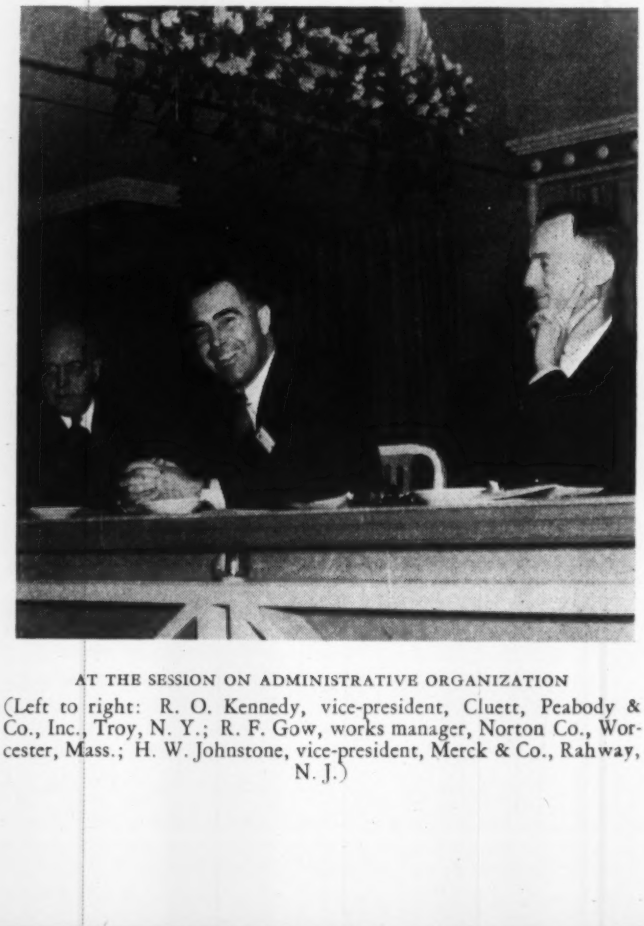
"The Boiler Code Committee of The American Society of Mechanical Engineers at its testimonial dinner to Dr. David Schenck Jacobus on Monday, Dec. 1, 1941, wishes to express to him its deep appreciation of all that he has done for the Committee, for the Society, and for the profession of engineering of the world, during his long association with them. They also wish to express their affection for him and admiration for his high character and outstanding tact in handling serious personal and scientific problems."

On behalf of the National Board of Boiler and Pressure Vessel Inspectors, which had elected Dr. Jacobus an honorary member in May, C. O. Meyers presented a handsomely illuminated parchment on which were engrossed the resolutions passed by the National Board.

In responding to Dean Greene and Mr. Meyers, Dr. Jacobus expressed his appreciation and gratification and spoke of the importance of the Boiler Code Committee's work. In closing his brief response he said: "There is no better reward than that which comes through the endorsement and confidence of one's friends and there will be no more cherished memories than the hours spent with my loyal co-workers. I wish the new chairman every success and hope he will have as much pleasure as I did in conducting the work."

E. R. Fish, who replaces Dr. Jacobus as chairman of the Boiler Code Committee, was then called upon. He read a tribute to Dr. Jacobus and the Committee, reviewed his connection with it, and some of the incidents in its history and development. The addresses of A. M. Greene, Jr., D. S. Jacobus, and E. R. Fish, will be published in a later issue.

W. A. Hanley, president A.S.M.E., spoke briefly and James W. Parker, president-elect A.S.M.E., proposed a toast to Dr. Jacobus. Mr. Parker recalled his early experiences with Dr.



AT THE SESSION ON ADMINISTRATIVE ORGANIZATION

(Left to right: R. O. Kennedy, vice-president, Cluett, Peabody & Co., Inc., Troy, N. Y.; R. F. Gow, works manager, Norton Co., Worcester, Mass.; H. W. Johnstone, vice-president, Merck & Co., Rahway, N. J.)

Jacobus during the famous Delray boiler trials. The success of the Committee, he said, had been based on the fact that the personal honor of engineers rose above all thought of personal gain.

The serious business of the dinner having thus been concluded, Mr. Oatley called for reports of subcommittees of the Committee on Personal Mentality, which were delivered as a burlesque on the deliberations and personal characteristics of the Boiler Code Committee and its members.

IV—PHOTOGRAPHIC EXHIBIT

Throughout the 1941 Annual Meeting a photographic exhibit was on display in one of the corridors of the eighth floor of the Astor. The photographs were entered by members of the Society and judged by a committee consisting of Louis Ciarico, A. S. Hoke, Joseph Renz, and Joseph Arthur. In addition to the photographs there were many excellent examples of sketching in crayon and painting in water color, pastel, and oil.

AWARDS IN PHOTOGRAPHIC AND GRAPHIC ARTS EXHIBIT, A.S.M.E. 1941 ANNUAL MEETING

	PHOTOGRAPHS	
Award	*Title*	*Name*
First in Show	Twilight	E. A. Alenius
Second in Show	Winter Afternoon	Leonard Ochtman, Jr.
First Member	Eric Sjolln	F. D. Whistler
Second Member	Son of a Sea Cook	G. G. Hyde
First Nonmember	Shadows on Snow	Nat Norman
Second Nonmember	Old Queens	J. J. Mulhern
Member		
Portrait	W.P.A.	W. L. Betts
Landscape	Winter Afternoon	K. A. Reeve
Landscape (Tech)*	Sunset	W. E. Wollheim
Architecture	Sunlit Arches	F. E. Peturee
Genre	Hold Still Daddy	F. P. McCormack
Nonmember		
Portrait	Dan'l	Leo Dinnar
Portrait (Tech)*	Study	T. G. Converse
Landscape	Sky and Sea	Luis Gibson
Architecture	Brewster Homestead	Fred Carisi
Genre	Royal Bengal	F. J. Gaffney
	GRAPHIC ARTS	
First in Show	Landscape in England	A. E. R. de Jonge
Second in Show	Eric	Lois Gimpel
Pastel	In Port Menemsha	David Moffat Myers
Oil	Glousterman	D. E. Warner
Etchings	Late Afternoon	H. L. Doolittle
Water Color	Landscape	L. T. Jurgensen
Oil	Fog in Cleveland	Grace Stewart
Oil	Melise Humphreys	C. Corriols

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* Because of lack of response in the technical and industrial group, the judges awarded the medals allotted to ties in other groups.

Acme

THREE NEW HONORARY MEMBERS OF THE A.S.M.E.

(Left to right: Major General Charles M. Wesson, Chief of Ordnance, U. S. Army; Clarence Decatur Howe, Minister of Munitions and Supplies for Canada; Rear Admiral Samuel M. Robinson, Chief of the Bureau of Ships, U. S. Navy.)

AT DEFENSE PRODUCTION SESSION

(Left to right: H. E. Linsley, Technical Associate, Public Relations Division, Wright Aeronautical Corporation, Paterson, N. J.; J. Allan Harlan, U. S. Ordnance Department; Lt. Col. H. F. Safford, Works Manager, Watervliet Arsenal, Watervliet, N. Y.)

By special arrangement, opportunity was afforded the editors of MECHANICAL ENGINEERING to choose for publication such entries in the photographic exhibit as best fitted their needs. This issue contains some of these selections.

The names of the prize winners will be found in the accompanying table.

V—EXCURSIONS

The Committee on Plant Trips arranged a comprehensive program of worth-while inspection trips and were rewarded for their efforts by the many who took advantage of the occasion.

Air-conditioning equipment for a large office building was of interest to many who had an opportunity at the Metropolitan Life Insurance Building to inspect centrifugal compressors of 325, 375, and 600 tons, cooling tower, ammonia and CO_2 ice machines, power plant, and building services. Joseph F. Carman, chief engineer, acted as host and informed the group that the 600-ton compressors had been in service for about a year and that the equipment in general had been in use for several years, affording valuable technical data.

The E. R. Merrill Spring Works in New York City also proved of interest, especially to members of the Mechanical Springs Committee. William H. Foster, Sr., was host to the group which saw steel springs being manufactured, wound, formed, heat-treated, and tested and judging from the interest in the trip it was time well spent.

Perhaps the drawing card of the excursions was the F. and M. Schaefer Brewing Company plant in Brooklyn, if the number who attended indicated anything, as over two hundred were on that trip. The host was F. N. Rickers, Sr., who showed the group the large new addition to the plant, the brewing process, bottling division, handling equipment, and power plant.

JOHN C. PARKER, W. F. DRYSDALE, PHILIP D. REED

PANEL OF EXPERTS

SEATED: F. J. ALLEN, W. L. H. DOYLE, H. N. DAVIS, P. D. REED; STANDING: R. M. GATES, L. C. MORROW, WHO ARRANGED THE CONSERVATION SESSION

SEATED: F. J. ALLEN, C. E. SMITH, H. N. DAVIS, P. D. REED; STANDING: D. R. KELLOGG, W. A. STRAW, W. F. DRYSDALE, W. L. H. DOYLE, L. C. MORROW, R. M. GATES, W. W. FINLAY

THE CONSERVATION WING

THE RECLAMATION WING

At the Conservation and Reclamation Clinic on Tuesday Evening

The New York Testing Laboratories in New York City also drew a good crowd. These scientific and commercial laboratories test materials for physical, chemical, electrical, and magnetic properties, make X-ray and gamma-ray examinations, physical measurements, and so on. The host, Gene J. Horitz, technical director, showed the group the modern testing equipment and explained the methods employed.

The last of the trips was to the Hotel New Yorker where again all building facilities were inspected in general with particular care devoted to the steam boilers convertible to oil or pulverized coal, Diesel engines, air conditioning, and ice machinery, elevator equipment, and laundry. The intricate workings of a large hotel are always fascinating and Warren D. Lewis, chief engineer, the host, explained the many tasks which are necessary to make the wheels go round and everyone comfortable.

VI—COLLEGE REUNIONS

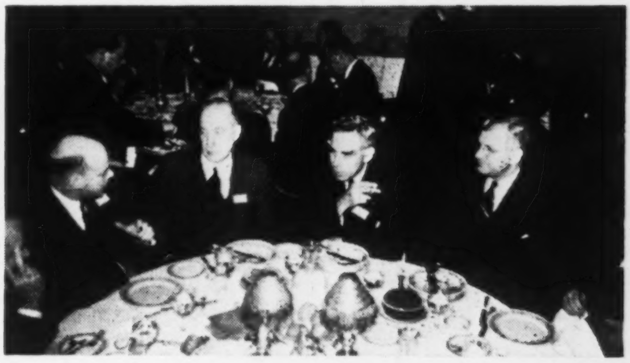
Alumni reunions of twelve engineering colleges were held in connection with the 1941 A.S.M.E. Annual Meeting.

The Brown Engineering Association held an informal luncheon meeting at the Hotel Bristol on Thursday.

The Columbia Engineering School Alumni Association held a small luncheon "get-together" on Thursday at the Columbia University Club.

A dinner of the Cornell Society of Engineers was held on Thursday evening at the Cornell Club and was addressed by Patrick Walsh, Fire Commissioner, City of New York; Prof.

SECRETARY DAVIES CALLS THEM BY NAME AT THE COUNCIL SUPPER SUNDAY EVENING

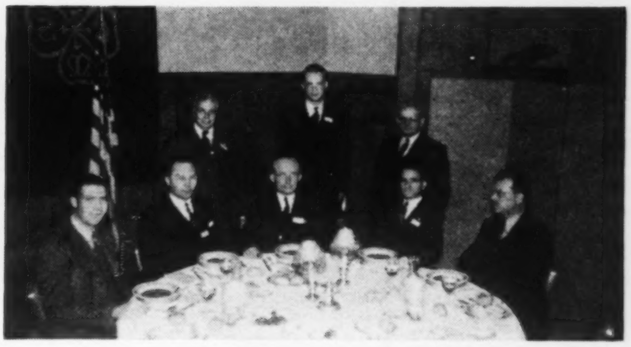


JAMES W. PARKER, E. G. BAILEY, H. N. DAVIS, AND C. E. DAVIES AT COUNCIL LUNCHEON ON MONDAY

R. E. DOHERTY DELIVERING REPORT ON E.C.P.D. AT BUSINESS MEETING

JOSEPH L. KOPF, CHAIRMAN OF FINANCE COMMITTEE REPORTS AT BUSINESS MEETING

AT WORKS STANDARDIZATION DINNER MONDAY EVENING



AT THE AVIATION DINNER ON TUESDAY EVENING

Here and There at the Annual Meeting

John R. Bangs, Cornell University; and Lieut. J. Clement Boyd, U. S. Navy.

The Harvard Engineering Society met at the Harvard Club on Thursday evening.

The Technology Club of New York, made up of the alumni group of M.I.T., held a smoker at the Club House on Thursday evening, in honor of the New York area alumni from the Class of 1941. The speaker was Horace S. Ford, treasurer of M.I.T.

The annual reunion of administrative, industrial, and mechanical-engineering graduates of New York University was held on Thursday evening at the New York University Faculty Club, Washington Square. The speaker was William A. Rose.

The reunion dinner of Pratt Institute was held on Thursday evening at Child's Restaurant in West 42nd Street. Doctor Doll, course superintendent of mechanical engineering at Pratt, was the speaker.

The Purdue Club of New York City held its Annual Dean Potter Night at the Building Trades Employers Association clubroom. Dean A. A. Potter spoke about last year's activities at Purdue.

The Rensselaer Alumni Association, New York Chapter, held a dinner at the Building Trades Club on Monday evening.

An alumni dinner of the Stevens Institute of Technology was held at the Stevens Metropolitan Club, Thursday evening.

An informal reunion luncheon of Tufts College alumni was held at the Zeta Psi Club on Thursday.

The Yale Engineering Association held a smoker on Thursday evening at the Yale Club of New York City. The athletic director, Ogden Miller, spoke on undergraduate athletics and Coach "Spike" Nelson showed movies of the Yale-Harvard game.

VII—TECHNICAL COMMITTEE MEETINGS

The technical sessions were paralleled this year by a group of 36 technical committee meetings. These meetings extended from Sunday afternoon to Friday evening. They were divided among the several groups as follows: Research, 15; Standards, 13; Power Test Codes, 6; Safety, 1; and Boiler Code, 1. The total attendance at these meetings was 481.

THE RESEARCH GROUP

This group of committee meetings was opened Sunday afternoon by a joint session of the A.S.M.E. Research Committee and the research secretaries of the A.S.M.E. professional divisions. The following members of the Research Committee were present: Chairman E. G. Bailey, M. D. Hersey, J. F. Downie Smith, and H. Weisberg. The group of research secretaries was represented by F. H. Clark, J. W. Cox, T. B. Drew, E. H. Hempel, C. F. Kayan, A. F. Murray, R. A. Sherman, and A. Weisselberg. The principal topic of discussion at this joint session was the proposed procedure in the usual allocation of research projects and problems by the A.S.M.E. Research Committee when received from the membership and industry which had been drafted previously by Chairman Bailey and distributed to the members of the main committee and the research secretaries for study. This procedure was approved in practically the form in which it was presented. The secretaries were then called on one by one to report on the prospects of initiating research projects of some kind in the industries which their divisions are serving.

At the close of the joint session the main committee went into executive session. Its first order of business was the election of the chairman for the coming year. Prof. W. Trinks is the new chairman. Chairman Bailey then introduced to the meeting Herman Weisberg who has been appointed by President Parker to serve out the unexpired term of J. H. Walker resigned and J. F. Downie Smith who has been appointed to serve for the five-year term in the place of Mr. Bailey whose term expired with that meeting.

The committee then received and discussed the informal reports of the chairmen of the special research committees who were present. The formal reports for the year ending October first had been included in the standing committee's report to the Council.

Fifteen special and joint research committee meetings were held during the five days of Annual Meeting week. They were all well attended and in each case good progress was recorded.

The annual meeting of the Special Research Committee on Lubrication, G. B. Karelitz, chairman, held on Tuesday morning was well attended and definite plans for new studies during the coming year were outlined. That afternoon this committee sponsored a technical session on this subject. A. L. Beall presided at this session and W. E. Campbell served as recorder. Both are members of the committee. The four papers presented at this session were: "Characteristics of Centrally Supported Journal Bearings," by E. O. Waters; "Heat Conditions in Bearings," by M. D. Hersey; "Effect of Diametral Clearance on the Load Capacity of a Journal Bearing," by J. T. Burwell; and "Notes on Heat Dissipation in Self-Contained Bearings," by G. B. Karelitz. The last three of these papers constituted a symposium on the subject of thermal conditions in bearings.

This year the Special Research Committee on Fluid Meters celebrated the twenty-fifth year since its organization and the continuous chairmanship of R. J. S. Pigott. An account of the testimonial dinner given to Chairman Pigott appears in the A.S.M.E. News section of this issue. The committee held its regular annual meeting on Tuesday afternoon at which fifteen were present.

Twenty four sat around the table that same afternoon attending a meeting of the Joint Research Committee on the Effect of Temperature on the Properties of Metals. Chairman N. L. Mochel presided and a spirited discussion of the problems before the committee for solution lasted the full three-hour period.

Tuesday afternoon and evening found the Joint Research Committee on Boiler Feedwater Studies presenting the results of its work on caustic embrittlement to the Society, Chairman C. H. Fellows presided at these two technical sessions and J. B. Romer served as recorder. The titles and authors of the afternoon session were: "Results of Laboratory Embrittlement Testing of Boiler Waters at the University of Illinois," by F. G. Straub; "Embrittlement of Boiler Steel—Experiences With the Schroeder Detector," by T. E. Purcell and S. F. Whirl; "Experience With Intercrystalline Cracking on Railroads," by R. C. Bardwell and H. M. Laudemann. The papers presented at the evening session were: "Studies on the Cracking of Boiler Plate," by P. G. Bird and E. G. Johnson; "Field Data From the Embrittlement Detector," by E. P. Partridge, C. E. Kaufman, and R. E. Hall; and "Summary," by W. C. Schroeder and A. A. Berk. Between the two sessions twenty-nine members of the committee and their friends sat down to dinner together.

The Special Research Committee on Mechanical Springs, J. R. Townsend, chairman, held its meeting on Wednesday morning and sponsored a technical session on Wednesday afternoon. The chairman presided at the session and Secretary C. T. Edgerton acted as recorder. The program of the session was in two parts, a paper on "Relaxation Resistance of Nickel-Alloy Springs," by B. B. Betty, E. C. MacQueen, and Carl Rolle; and a "Symposium on Formulation of Code for Design of Helical Springs" at which the following five short papers were presented, "Scope of the Problem—What Does the Practical Spring Designer Need?" by J. K. Wood; "Design Stresses for a Standard Code," by A. M. Wahl; "Spring Tables—Hints on Scope and Arrangement," by H. C. Keysor; "Nomographic Charts—Advantages and Disadvantages," by L. C. Peskin; "Further Research Work Required," by M. F. Sayre.

The new Special Research Committee on the Forging of Steel Shells, M. D. Stone, chairman, held an afternoon and an evening session on Wednesday. Ten members of the committee were present.

On Thursday both morning and afternoon the Special Research Committee on Strength of Vessels Under External Pressure, F. V. Hartman, chairman, held meetings at which the principal subjects of discussion were: (1) allowable pressures on thick-walled metallic tubes subjected to external pressure, and (2) use of aluminum-manganese alloy in unfired pressure vessels under external pressure.

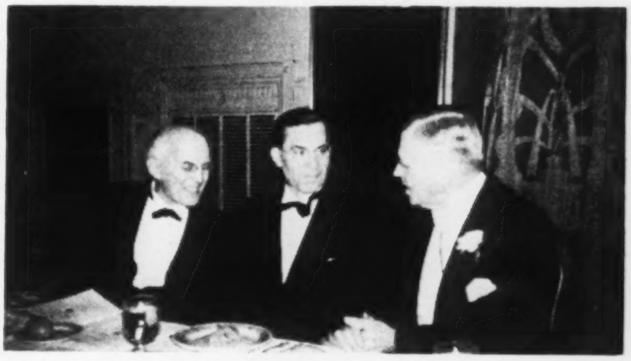
The Special Research Committee on Cutting of Metals sponsored a session on Thursday afternoon at which Chairman M. F. Judkins presided and Secretary L. N. Gulick served as recorder. The paper presented at that session was "Correlation of Coefficient of Friction With Drilling Torque and Thrust for Different Types of Cutting Fluids," by A. O. Schmidt, W. W. Gilbert, and O. W. Boston.

Meetings at which the business was principally of a routine character were held during the week also by the committees on Effect of Solution Composition on the Cracking of Boiler Metal, J. H. Walker, chairman; Rolling of Steel, A. N dai, chairman;

WILLIAM A. HANLEY DELIVERS PRESIDENTIAL ADDRESS

DONALD M. NELSON, SPEAKER AT THE DINNER

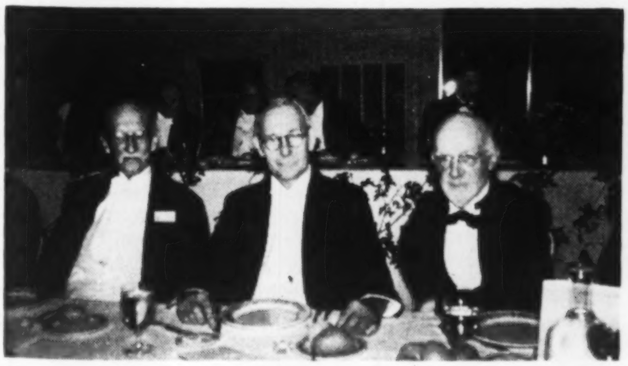
CLARENCE DECATUR HOWE, JAMES W. PARKER, DONALD M. NELSON, AND W. L. BATT



GEO. I. ROCKWOOD, JOHN C. GARAND, HOLLEY MEDALIST, AND MAJOR GENERAL C. M. WESSON

PRESIDENT HANLEY AND MAJOR GENERAL WESSON

THE RECEIVING LINE AT PRESIDENTS' RECEPTION



PAST-PRESIDENT D. S. JACOBUS, REAR ADMIRAL S. M. ROBINSON, AND PAST-PRESIDENT WILLIAM F. DURAND

PRESIDENT HANLEY CONFERS HONORARY MEMBERSHIP UPON CLARENCE DECATUR HOWE

At the Annual Dinner on Wednesday Evening

Condenser Tubes, A. E. White, chairman; Boiler Feedwater Studies—Executive Committee, C. H. Fellows, chairman; Cutting of Metals, M. F. Judkins, chairman; Subcommittee on Cutting Fluids, O. W. Boston, chairman; and Critical Pressure Steam Boilers, of which H. L. Solberg is chairman.

One of the features of this annual meeting was the holding of two sessions, Thursday morning and Thursday afternoon, on "Furnace Heat Transmission." These sessions were arranged for and sponsored by the A.S.M.E. Research Committee with the cooperation of the professional divisions on Fuels, Power, and Heat Transfer. E. G. Bailey, chairman of the Research Committee, presided at both sessions, and T. B. Drew acted as recorder. The following took part in the prepared discussion: W. F. Davidson, P. H. Hardie, C. G. R. Humphreys, A. A. Markson, A. R. Mumford, and T. Ravese.

STANDARDS GROUP

The A.S.M.E. Standardization Committee opened the group of standards committee meetings by a well-attended meeting on Monday morning. This was the annual meeting of the committee and it received the report of C. B. Le Page, secretary, and conducted routine business. One important item in the secretary's report was the statement that during the Society's fiscal year twelve standards had been completed or revised and transmitted to the American Standards Association. It was reported also that at the time of the meeting six additional standards had been completed by the sectional committees and were passing through the final approvals required in the procedure of the A.S.A.

The progress made by the other standards committees for which the Society is sponsor or joint sponsor is recorded in the standing committee's annual report which is published as a part of a separate pamphlet available on application to A.S.M.E. headquarters.

Another item on the order of business was the election of the new chairman of the committee. A. L. Baker, the retiring chairman, called for nominations and J. E. Lovely was nominated and unanimously elected chairman for the year 1941-1942. The committee was then informed that President J. W. Parker had approved its recommendation for the appointment of J. Hall Taylor as the 1941 addition to the committee's personnel.

By far the largest group of standards committees to hold meetings this year is that organized by the Sectional Committee on the Standardization of Small Tools and Machine Tool Elements, B5, of which W. C. Mueller is chairman and P. L. Houser is secretary. In all, six meetings were held including the annual meeting of the sectional committee.

Twelve attended the meeting of Technical Committee No. 9 on Punch Press Tools of which C. D. Carter is the new chairman. Taking up the work where T. W. Ragan, the former chairman, had laid it down, the committee perfected definite plans for the drafting of a proposed American Standard on the subject.

The largest meeting of this group was that called by S. O. Bjornberg, Chairman of Technical Committee No. 13 on Splines and Splined Shafts. This meeting was planned as a joint meeting of Technical Committee No. 13 with the S.A.E. Subcommittee E7 on Involute Splines of the Aircraft Engine Subdivision of the Aeronautics Division, G. Carvelli, chairman, and the Committee on Keyways and Splines of the A.G.M.A., J. L. Buehler, chairman.

Nineteen members of these committees were present and took part in the framing of a program of standardization of splines for the various types of application.

Technical Committee No. 2 on Tool Posts and Tool Shanks, O. W. Boston, chairman, at its meeting on Wednesday afternoon completed the revision of the present American Standard B5b–1929.

Unusual interest in the work of Technical Committee No. 21 on Tool-Life Tests for Single-Point Tools, O. W. Boston, chairman, was shown at its meeting on Thursday morning. Eleven persons were present.

Thursday afternoon was the time set for the annual meeting of Sectional Committee B5. At this meeting the sectional committee receives the reports of its technical committees which have been active during the last year. This year the report which was given the greatest amount of attention was that of Technical Committee No. 3, E. J. Bryant, chairman. This committee formally presented a revision of American Standard for Machine Tapers, Self-Holding Taper Series, B5.10–1937. The report was accepted and the proposed revision was slightly revised and was ordered to be sent to the members of Technical Committee No. 3 and to Sectional Committee B5 for approval.

A new subcommittee of Sectional Committee B1 held its organization meeting on Friday morning on the 15th floor of the Engineering Societies Building. This subcommittee is headed by W. H. Gourlie as chairman and was appointed by Chairman R. E. Flanders to develop a section of the American Standard for Screw Threads, B1.1–1935, which will meet the needs of those who manufacture and use bolts, studs, and nuts in high-temperature service.

Meetings of a routine nature were held also by the Subcommittee on Wire and Sheet Metal Gages, B32, H. W. Tenney, chairman; Executive Committee of the Sectional Committee on Safety Code for Elevators, A17, D. J. Purinton, chairman; Subgroup on Spring Washers, B27, E. D. Cowlin, presiding; and the Editing Committee on Screw Thread Gages and Gaging, B1, A. M. Houser presiding. The Subgroup which is developing the proposed American Standard Plumbing Code held a two-day meeting. Messrs. A. H. Morgan and C. S. Cole are the chairman and secretary, respectively, of this committee.

POWER TEST CODES

The power test codes group of technical committees numbered six this year. All day Sunday the new Joint A.I.E.E.-A.S.M.E. Committee on Specifications for Prime Mover Speed Governing was in session working on the problem assigned to it. M. J. Steinberg is chairman.

Two of the committees met on Monday morning. Technical Committee No. 17 on Internal-Combustion Engines, Lee Schneitter, chairman, and F. H. Dutcher, secretary, were in session for the full period putting the finishing touches on the present revision of the present A.S.M.E. Test Code for Internal-Combustion Engines.

The second power test code committee to hold its meeting on Monday was Technical Committee No. 2 on Definitions and Values, R. J. S. Pigott, chairman. This committee also worked on its revision of the combined codes dealing with "Definitions and Values."

The annual get-together of all those at work on power test codes for the Society was held this year on Tuesday morning. Invitations had been previously sent to 205 members of the Society and other specialists included in this group of workers. Forty six were present at the meeting. Francis Hodgkinson, chairman of the main committee, presided and led the committee through a long program of more or less routine business.

It was announced that President Parker had appointed the following five members of the Society to the Committee for the five-year period beginning December 1, 1941: A. G. Christie, Paul Diserens, N. R. Gibson, Geo. A. Orrok, and E. B. Powell.

It was also reported that J. A. Keene had been named one of the two junior observers of the committee.

Prof. L. S. Marks of Harvard University by letter addressed to the chairman, Francis Hodgkinson, and by oral discussion at this meeting urged the committee to advocate the adoption by the Society of one standard unit in which to measure and report the heat transfer. He recommended the adoption of the "watt" for this purpose. The members of the committee seemed to favor his proposal and encouraged Professor Marks to develop the proposal further.

The handling of the draft codes when they are released by the several technical committees was the subject of an extended discussion. The present procedure calls for the appointment of a new editing committee to handle the editing of each draft code as it comes along. The committee finally voted to refer this subject for study and report to a special committee consisting of E. B. Ricketts, chairman, Louis Elliott, and P. H. Hardie.

On Tuesday afternoon Technical Committee No. 13 on Refrigerating Systems, B. H. Jennings, chairman, held a meeting and on Wednesday afternoon Technical Committee No. 18 on Hydraulic Prime Movers, S. Logan Kerr, chairman, held its annual meeting at which fourteen were present and business connected with the development of the supplements to the A.S.M.E. Test Code for Hydraulic Prime Movers was transacted.

VIII—ANNUAL MEETING COMMITTEES

Conduct of the 1941 A.S.M.E. Annual Meeting was under the jurisdiction of the Committee on Meetings and Program, but the numerous details of technical and social gatherings and the planning of hundreds of events call for cooperation of practically every other standing committee and for the active support of many special committees.

Heading the Committee on Meetings and Program for 1941 was Walter J. Wohlenberg and supporting him were A. L. Kimball, N. E. Funk, L. K. Sillcox, and F. G. Switzer, members of the Committee.

The Special Committees set up for the 1941 Annual Meeting were as follows:

DINNER AND HONORS NIGHT: E. J. Billings, *chairman;* P. E. Frank, *vice-chairman;* C. A. Hescheles, Seating; J. C. Falkner, Music and Dancing; H. E. Martin, Ushers; S. H. Libby, "Old Guard;" Mrs. E. C. M. Stahl, AS K ME Girls.

PHOTOGRAPHIC GROUP: F. P. McCormack, *chairman*, G. G. Hyde, W. L. Betts, C. G. Humphreys, R. C. Petura.

PLANT TRIPS: Robert B. Dale, *chairman*, James W. Gibbons, Harold L. Lipschultz.

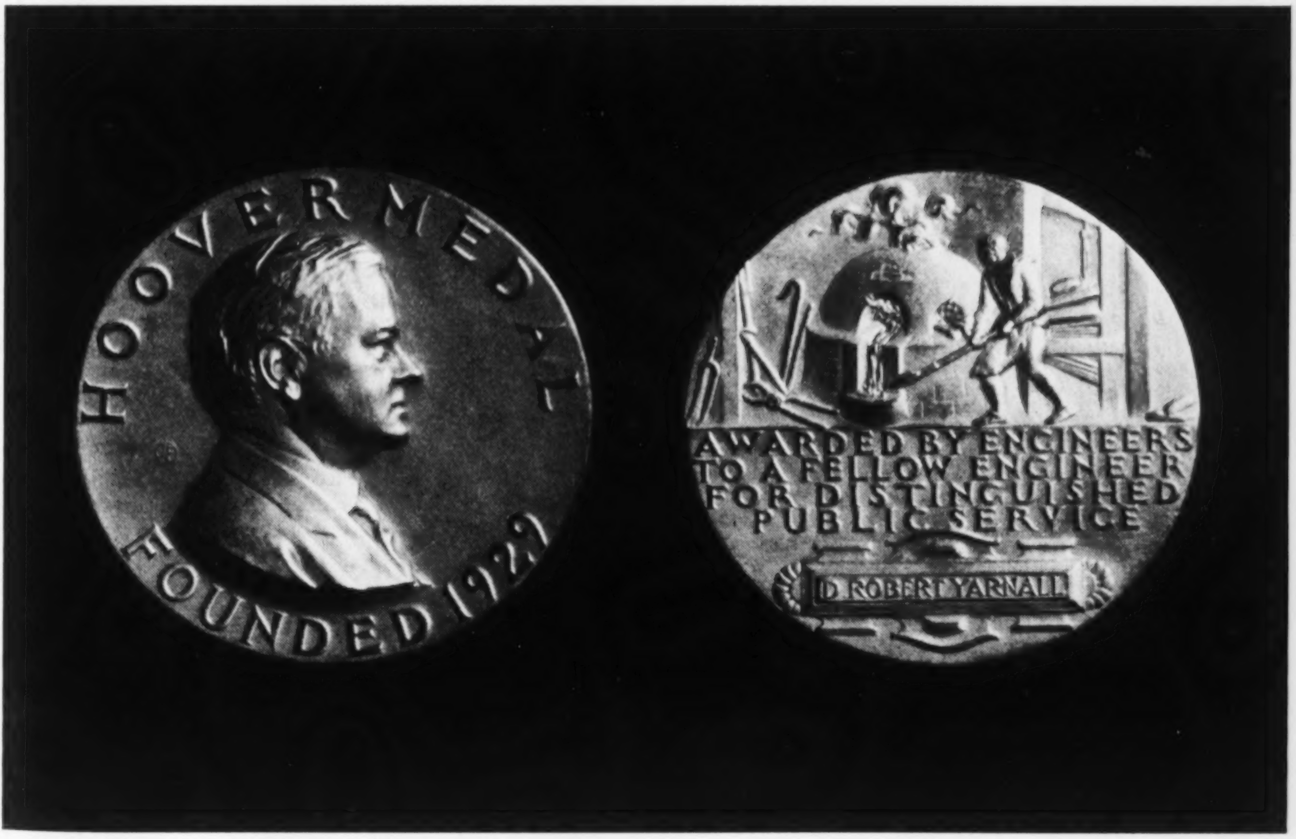
ENTERTAINMENT: Paul T. Onderdonk, *chairman*.

NATIONAL DEFENSE LUNCHEON—LUNCHEON TICKET SALE: H. D. Strong, Jr., *chairman*.

TECHNICAL SESSIONS: E. E. Jackson, P. T. Wetter.

STUDENT AIDES COMMITTEE: Austin H. Church, E. H. Fezandie, John W. Hunter, C. F. Kayan, Allen T. Kniffen, H. F. Ritterbusch, S. J. Tracy, Wm. A. Vopat.

[NOTE: Reports of the Group Delegates Conference, student activities, and the Woman's Auxiliary will be found in the A.S.M.E. News Section of this issue.—EDITOR.]


HOOVER MEDAL
FOUNDED 1929
AWARDED BY ENGINEERS TO A FELLOW ENGINEER FOR DISTINGUISHED PUBLIC SERVICE
D. ROBERT YARNALL

THE 1941 HOOVER MEDAL AWARDED TO D. ROBERT YARNALL

A.S.M.E. BOILER CODE

Interpretations

THE Boiler Code Committee meets monthly for the purpose of considering communications relative to the Boiler Code. Anyone desiring information on the application of the Code is requested to communicate with the Committee Secretary, 29 West 39th St., New York, N. Y.

The procedure of the Committee in handling the cases is as follows: All inquiries must be in written form before they are accepted for consideration. Copies are then sent by the Secretary of the Committee to all of the members of the Committee. The interpretation, in the form of a reply, is then prepared by the Committee and is passed upon at a regular meeting of the Committee.

This interpretation is later submitted to the Council of The American Society of Mechanical Engineers for approval after which it is issued to the inquirer and published in MECHANICAL ENGINEERING.

Following is a record of the interpretations of this Committee formulated at the meeting of October 31, 1941, subsequently approved by the A.S.M.E. Council.

ANNULLED CASES

Case No.	Paragraph	Case No.	Paragraph
826	U-20(*c*)	911	U-68(*b*)
848	....	912	U-66(*a*)
865	U-20	913	P-23, P-24
870	P-115	914	U-66
876	P-200	915	P-274
877	U-64	916	U-13(*e*), U-20(*a*)
893	A-20(*h*)	918	P-300
894	P-299(*e*)	919	U-59, U-76
895	Spec. S-48	921	U-12(*a*)
906	U-73(*a*)	922	P-299(*b*)
907	U-73(*a*)	927	U-94
908	P-268(*o*)	928	P-113
910	P-112(*a*)	930	P-103(*a*), U-71(*a*)

CASE No. 897 (*Revised item (2) of reply*)

(2) *Specifications*. The alloy chromium-nickel material shall conform to Specification S-62 for sheets and plates; to Specification S-52, austenitic grades T8(S), T18(T), T19(C), and T20(M), for seamless tubes; to A.S.T.M. Specifications A249-41T, grades T8(S), T18(T), T19(C), and T24(M), except that the carbon content shall not exceed 0.08 per cent for welded tubes, subject to the following modifications and added requirements. Structural shapes, bars, pipes, and forgings made to the same specifications, so far as applicable, may be used. The chemical requirements of Specification S-62 may be substituted for chemical requirements either in Specification S-52 for seamless tubes, or in A.S.T.M. Specifications A249-41T for welded tubes.

a Chemical composition of the alloy shall conform to the respective specifications except as follows:

(I) Under Specification S-62, 0.08 per cent carbon maximum instead of 0.07 per cent carbon maximum shall be acceptable pending revision of that specification in this respect;

(II) Under any of the specifications 0.10 per cent carbon maximum shall be acceptable for uses in which the purpose of the stainless steel is to prevent contamination of the contained product. The use of 0.10 per cent carbon in S and M grades shall not be permitted for vessels subjected to corrosive agents other than such contained product. It must be recognized that the use of 0.10 per cent carbon in the S and M grades presents the danger of intergranular corrosion and in such cases frequent service inspection is necessary to assure safety of the vessels;

(III) Under any of the specifications 0.10 per cent carbon maximum in C and T grades shall be acceptable for uses in which the corrosive conditions are mild.

b Marking. In addition to the marking required by the specification, the heat-treatment ((3)*a*, *b*, or *c*) shall be marked in like manner.

CASE No. 947 (*Special Ruling*)

Inquiry: In view of the present difficulty in obtaining noncorrosive materials, will it be permissible under Par. P-296 of the Code to use ferrous pipe and fittings for steam gage connections for 250 lb pressure and less, and the corresponding temperature for saturated steam?

Reply: It is the opinion of the Committee that in view of the present difficulty in obtaining noncorrosive materials, the use of ferrous pipe and fittings in steam gage connections for pressures under 250 lb saturated is permissible if the diameter is not less than $^1/_2$ in. pipe size.

CASE No. 952 (*Interpretation of Standard Qualification Procedure*)

Inquiry: Has the Standard Qualification Procedure for the Power Boiler Code, the Miniature Boiler Code, and the Unfired Pressure Vessel Code been modified?

Reply: Section IX of the Code has just been issued to bring the rules up to date and may be used in place of Pars. A-100 to A-123 referred to in Par. P-112, Pars. MA-1 to MA-24 referred to in Par. M-4, Pars. UA-30 to UA-53 referred to in Par. U-68(*b*), and Pars. UA-30 to UA-70 referred to in Pars. U-69 and U-70.

CASE No. 953 (*Interpretation of Pars. P-102(h) and U-68(h)*)

Inquiry: The Code states that when radiographing welded joints, the penetrameters must be placed on the radiation side of the work. When radiographing a circumferential pipe joint by placing a radium capsule inside of the pipe, it is often very difficult and expensive to place the penetrameters inside of the pipe. Is it permissible in such cases to place the penetrameters on the outside or film side of the joint under examination?

Reply: In the situations cited in the inquiry, it is the opinion of the Committee that the penetrameters may be placed on the film side of circumferential pipe joints, provided the following additional requirements are satisfied:

(*1*) A preliminary radiograph shall be made with a short piece of pipe with penetrameters on both the inside and outside. The diameter of the pipe employed in making this proof radiograph shall be the same as that of the job in hand, and its wall thickness shall be equal to that of the over-all thickness of the joint to be radiographed, including both backing ring and reinforcement if these are present in the joint to be examined. The radium capsule employed in making this proof radiograph, together with all other items of technique such as the location of the capsule and the time of exposure, shall be the same as employed on the actual job. Each penetrameter shall be provided with a marker which will show up clearly on the film and which will indicate the side of the joint on which it is located; *F* for film side and *R* for radiation side.

(*2*) This proof radiograph together with the radiograph of the joint in question shall be submitted to the inspector who will then decide as to the efficiency of the radiograph of the actual joint with the penetrameters on the film side. Each such production penetrameter shall be provided with *F* marker referred to in (*1*).

(*3*) If both of these radiographs are satisfactory from the standpoint of penetrameter definition and contrast, the Code requirements for the minimum source distance, and for the minimum ratio of source distance to film distance, may be waived, but the ratio of source distance to film distance shall be clearly indicated on each production film.

(*4*) When the radium capsule is placed on the axis of the joint and the complete circumference radiographed with a single exposure, 4 penetrameters uniformly spaced shall be employed.

A.S.M.E. NEWS

And Notes on Other Engineering Activities

A.S.M.E. Affairs, Problems, and Policies Discussed by Local Sections Delegates

National Conference of Local Sections Group Delegates Held During 1941 Annual Meeting of A.S.M.E.

DEMOCRACY in action was never exhibited better than during the 1941 Annual Meeting of The American Society of Mechanical Engineers in New York when 16 delegates, representing Local Sections and more than 15,000 members throughout the country, met in conference, starting Sunday morning, Nov. 30, and lasting two and one half days, to discuss and analyze Society affairs, problems, and policies. Each delegate brought with him instructions and resolutions from his group conference, one of the eight held during the fall of 1941 in each of the eight geographical areas into which the Local Sections are divided for purposes of administration. Delegates are elected to serve for two years, and elections are made so that one new delegate for each group comes to the conference while the second delegate from that group is serving his second term of office.

After selection of a speaker, vice-speaker, and secretary, the Conference started off with the formation of committees to expedite its business, followed by the consideration of such topics as local sections activities, national society organization, publications, employment and welfare, professional development, junior members, National Defense, and postwar reconstruction. The Conference submitted an extensive report of its deliberations to the Council which referred the individual items of the report to the appropriate committees of the Society for consideration and report. In many cases, representatives of Society committees were invited to address the delegates or to answer questions during the conference.

Delegates to 1941 Conference

The delegates to the 1941 Conference were as follows: GROUP I: A. D. Andriola, New London, Conn., Norwich Section; H. F. Ramm, New Britain, Conn., Hartford Section; GROUP II: A. R. Mumford, New York, N. Y., Metropolitan Section; Wm. H. Larkin, New York, N. Y., Metropolitan Section; GROUP III: J. S. Morehouse, Villanova, Pa., Philadelphia Section; C. Schabtach, Schenectady, N. Y., Schenectady Section; GROUP IV: F. C. Smith, Atlanta, Ga., Atlanta Section; J. B. Jones, Blacksburg, Va., Virginia Section; GROUP V: C. T. Oergel, Marblehead, Mass., Boston Section (representing Erie, Pa., Section, his former residence); A. M. Selvey, Detroit, Mich., Detroit Section; GROUP VI: F. L. Ruoff, Fort Wayne, Ind., Fort Wayne Section; Ben G. Elliott, Madison, Wis., Rock River Valley Section; GROUP VII: A. D. Hughes, Corvallis, Ore., Oregon Section; H. T. Avery, Oakland, Calif., San Francisco Section; GROUP VIII: C. W. Crawford, College Station, Texas, South Texas Section; and Ray M. Matson, Dallas, Texas, North Texas Section. Mr. Mumford was the speaker of the conference, Mr. Smith was vice-speaker, and Mr. Hughes was secretary.

Committees appointed to expedite the business of the Conference included: Budget: C. T. Oergel, chairman, J. B. Jones, and Ray M. Matson; Membership: A. D. Andriola, chairman, Wm. H. Larkin, and Ben G. Elliott; Organization: C. W. Crawford, chairman, H. T. Avery, and H. F. Ramm; Agenda: J. S. Morehouse, chairman; Miscellaneous: F. L. Ruoff, chairman, C. Schabtach, and A. M. Selvey.

LOCAL SECTIONS DELEGATES ATTENDING THE ANNUAL MEETING

A.S.M.E. SPRING MEETING

at Houston, Texas, March 23–25, 1942, with Headquarters at Hotel Rice. Make room reservations early and mention A.S.M.E. Papers on Fuels, Heat Transfer, Petroleum, Power, Process Industries. See February issue for details.

Because he found it impossible to be present at the Friday meeting of the Council, the Speaker appointed Messrs. Hughes, Larkin, and Matson to prepare the report of the Conference and present it. Since more than 50 items were discussed at the Conference only the outstanding ones will be described here.

Problems of Juniors Discussed

As in previous years, the problems of Juniors were analyzed and certain recommendations made by the Conference. Mr. Matson made a motion, which was passed, that inasmuch as the machinery (Local Sections) already exists, it is felt that no committee be formed or a promotional campaign undertaken but instead that the Local Sections use their increased allotment for attacking the Junior problem. Furthermore, the Conference requested that those Juniors and Members of the A.S.M.E. on duty with the armed forces of the United States with a rank of noncommissioned officer or lower be furnished membership cards entitling them to the privilege of attending all meetings and further requested that they be carried on the printed list of the Society without the payment of regular dues. To help those already in the armed services, Mr. Smith moved that the A.S.M.E. be prepared to offer information to aid the inductees so that they can be placed in work compatible with their training and that this procedure of A.S.M.E. be publicized.

The Conference went on record to urge each Local Section to bring to the attention of the Juniors and their employers the potential or existing opportunities for further training in cooperation with the local colleges and universities. Upon a motion by Mr. Selvey, the Conference voted to commend the present action of Local Sections in supporting Junior activities and in inducting Juniors into Section committees and to urge that worth-while support be given by Local Sections at new centers where a definite demand exists for junior activities. A proposal by one of the groups that a subjunior grade of membership for recent graduates up to the age of 25 years be established was rejected unanimously by the Conference delegates. However, it was resolved upon a motion by Mr. Oergel that Local Section chairmen should at a suitable time and in cooperation with headquarters get in touch with the honorary chairman of a student branch to institute procedure prior to the end of the scholastic year by urging student members to transfer to the Junior grade.

Members' Difficulties Analyzed

Some members had complained that their membership applications had been unduly held up by the Committee on Admissions. The Conference invited Dean Robert L. Sackett, past-chairman of the Committee, to describe the workings of the group and the reasons for any delays. He stated that many times the amount of information given on the application is totally inadequate to allow the Committee to form a judgment of the suitability of the applicant as a member, sometimes the references cannot be reached or, if reached, do not say anything about the professional ability of the applicant. Upon a question from a delegate, Dean Sackett answered that much depends on the cooperation of the Local Sections on completeness of submitted record, references, etc., rather than just "rubber stamping" a man's application. The most important question which any member acting as a reference can ask himself is, "Will the applicant be a desirable member and a permanent one?" Upon a motion by Mr. Andriola, the Conference voted to approve the present system and urged that every opportunity be given to the Committee on Admissions to investigate the applicant.

Dr. F. L. Yerzley was given an opportunity to appear before the Conference and discuss his letter in which he urged that affiliate membership in the Society be revived. After much discussion among the delegates, it was voted upon a motion by Mr. Andriola to refer Dr. Yerzley's letter to the Committee on Membership for consideration and for the Conference to suggest that any action taken by the Committee should be such as to raise rather than lower the standard of membership in the Society.

K. M. IRWIN, W. A. CARTER, AND R. A. SHERMAN AT AN ANNUAL MEETING SESSION

The handling of correspondence between individual members and Society headquarters was referred to the Office Management Committee for careful study and consideration so that corrective measures could be taken to expedite equitable solution of individual member's problems. It was further requested that those problems which could not be quickly adjusted be referred to the Committee on Local Sections.

N. E. FUNK AND A. L. KIMBALL AT THE 1941 ANNUAL MEETING

Mr. Mumford explained how the new plan of the Engineering Societies Library to make most of its books available to members throughout the country operated. After study by the Organization Committee, the Conference adopted its report that the Committee on Local Sections take whatever steps are necessary to extend the use of local technical libraries for the benefit of members in that area.

Local Sections Activities

The Conference advocated closer cooperation between Local Sections within the various states to assure unified action in state affairs as they arise and to make possible the transmission of information to a Local Section in need of it or requesting same. Council was urged to encourage greater cooperation between local sections, colleges, and national organizations, including the E.C.P.D. To encourage closer relationship between the Local Sections and the Professional Divisions, both the Council and the Local Sections were requested to give some thought and effort toward the development of a technique for furthering that relationship and increasing the amount of Professional Division activity in the Local Sections.

J. M. LABBERTON TALKING TO E. S. MCCLELLAND, A 50-YEAR A.S.M.E. MEMBER

As a means of providing help to incoming Local Section officers, it was suggested by Mr. Oergel that the chairman of each section prepare a critical report of the principal activities of his group for the year and forward a copy of such report to Society headquarters. Mr. Selvey made a motion that each Local Section delegate to the group conferences come prepared with a report of his Section activities for the purpose of discussion and information.

Much of the material and many of the questions which were brought to the conference were found to be based on insufficient information. At the conference many problems are completely answered by discussion among delegates and by information supplied by chairmen of standing committees and by members of the staff. With this knowledge before them the delegates urged that group conferences provide time for full discussion of section problems and interchange of information on activities through local section reports to the conference.

A.S.M.E. Publications Praised

The publications of the A.S.M.E , such as MECHANICAL ENGINEERING, A.S.M.E. Transactions, codes, and standards, came in for their share of praise from the delegates. Questions regarding them were answered by the editor, George A. Stetson, who was invited to do so by the Speaker. It was the general consensus that the Society publications be handled as in the past except that some effort should be made to present more papers and engineering news items of interest to Juniors and student members.

It was moved by Mr. Andriola and accepted by the delegates that Society headquarters publicize a list of engineering societies with which reciprocal agreements exist for obtaining their publications at the same cost as their members and that if feasible such privileges be extended.

Secret Union Vote Rejected

The group voted upon a motion by Mr. Crawford to recommend strongly against a secret ballot to determine the attitude of members on the question of unionization and to ask Council to take definite action which will result in a coordinated policy of all engineering societies to solve this problem. It was felt that the Junior was being exposed to pressure from existing union groups and that steps be taken by the Society to help him clarify his situation.

Engineering Registration

The problem of licensing and registration was referred to Mr. Crawford's Organization Committee which brought in the recommendation that the Committee on Registration extend its activities to keep each Local Section informed of proposed changes in licensing laws and upon request from any Local Section make analysis of any proposed legislation; and that each Local Section appoint a liaison member to supply the Committee with all pertinent information about local licensing activities and also institute action by Local Sections in handling local problems.

National Defense

As the duty of every member and all citizens of the United States, it was suggested that every effort be made to assist the government during the emergency. However, it was also recognized that plans should already be under way for postwar reconstruction. In view of this, it was proposed that a national committee of the A.S.M.E. should be appointed to investigate William L. Batt's proposal and if possible formulate a definite plan of action.

Officers for 1942 Conference

As its last act, the delegates elected the following officers and committee chairmen for the 1942 Conference:

Speaker: Ray M. Matson; vice-speaker: H. T. Avery; secretary: J. B. Jones; budget: Ben G. Elliott; membership: H. F. Ramm; organization: Wm. H. Larkin; agenda: A. M. Selvey; and miscellaneous: C. Schabtach.

1942 John Fritz Medal Won by E. L. De Golyer

THE John Fritz Medal for 1942, highest distinction in the engineering profession, has been awarded to Everette Lee De Golyer, consulting petroleum engineer, of Dallas, Texas, and deputy for conservation under the Petroleum Coordinator for National Defense, it was announced recently. The award to Mr. De Golyer was made in recognition of his pioneer work in the application of geophysical exploration to the search for oil fields, a technique credited with the discovery of 3,000,000,000 barrels of oil in the United States alone.

The medal, sponsored by the American Society of Civil Engineers, The American Society of Mechanical Engineers, American Institute of Electrical Engineers, and American Institute of Mining and Metallurgical Engineers, will be presented to Mr. De Golyer on Jan. 14.

In 1940, Mr. De Golyer received the Anthony F. Lucas Gold Medal from the American Institute of Mining and Metallurgical Engineers of which he is a past-president. Other winners of the Fritz Medal include Thomas A. Edison, George W. Goethals, Orville Wright, Herbert Hoover, Guglielmo Marconi, and George Westinghouse.

Grover Keeth on Wisconsin State Board of Architects and Engineers

GROVER KEETH of Wausau has been appointed a member of the Wisconsin State Board of Architects and Engineers filling the vacancy made by the retirement of Prof. Leslie F. Van Hagen. Mr. Keeth is a member of the A.S.M.E. and is affiliated with the Milwaukee Section, which recommended Mr. Keeth to the Industrial Commission.

Pigott Honored at Dinner of A.S.M.E. Fluid Meters Committee

Has Served as Chairman for Twenty-Five Years

IN December, 1916, the A.S.M.E. Standing Committee on Research appointed a subcommittee, the Special Research Committee on Fluid Meters, and made R. J. S. Pigott its chairman, a position he has held continuously for the 25 years since that date. This is probably a unique record and to celebrate it and to show appreciation of Mr. Pigott's long service a number of his friends, members, past and present, of the Fluid Meters Committee, gave a dinner for him at the Hotel Astor on Tuesday, December 2.

Among those present to honor Mr. Pigott were W. A. Hanley, president of the Society; E. G. Bailey, chairman of the Standing Committee on Research; C. E. Davies, secretary of the Society; C. B. Le Page and Ernest Hartford, assistant secretaries; and Miss Jean Meyer, A.S.M.E. Technical Committees.

AFTER THE DINNER WAS OVER

(Seated, left to right: E. G. Bailey, R. J. S. Pigott, S. R. Beitler, and W. A. Hanley. Standing, left to right: J. Miller, Geo. F. Felker, M. C. Stuart, and R. M. Johnson.)

At the conclusion of the dinner Prof. S. R. Beitler of The Ohio State University, who acted as toastmaster, arose to read several telegrams of congratulation that had been sent to Mr. Pigott. Following the reading he spoke of the creation of the Fluid Meters Committee 25 years ago and gave a sketch of the career of Chairman Pigott.

The toastmaster then asked President Hanley to make some remarks and the latter in congratulating Mr. Pigott lauded him for his work not only for the Fluid Meters Committee but also in connection with many other important ones of the Society on which he has served faithfully and well.

Following Mr. Hanley the toastmaster called on Messrs. Davies, Pardoe, and Weymouth who also congratulated Mr. Pigott and stated they were pleased to add their meed of praise to what Mr. Hanley had given.

Professor Beitler then asked Dr. Zucrow if he wished to say a word and he replied that he had no desire to talk but that on behalf of Mr. Pigott's many friends and as a token of their good wishes he wished to present him with a memento of this occasion and handed him, as their gift, a gladstone bag, a brief case, and a fitted toilet case.

After the presentation Mr. Beitler asked Mr. Bailey, as chairman of the Standing Committee on Research and an old and valued friend of Mr. Pigott's, to tell something about the honor guest.

Mr. Bailey stated that he had no set speech for this occasion and that if he had he would not deliver it as he thought it was about time to change the tenor of the speeches and he proposed to do it.

He then gave, in a humorous vein, a sketch of Mr. Pigott's career that differed radically from the one presented by Mr. Beitler and that brought forth much laughter from the assemblage.

Finally, the toastmaster asked Mr. Pigott if he would care to make any remarks. Mr. Pigott then arose and replied to the words of welcome and congratulation; spoke feelingly of his work with the Fluid Meters Committee, noting how much the membership had done to make his efforts a success; related incidents that had high-lighted his chairmanship; and warmly thanked all those who had contributed in any way to the making of such a delightful and happy evening for him.—J. R. CARLTON.

A Charge to Be Made for Meeting Preprints

STARTING with the A.S.M.E. Spring Meeting at Houston, Texas, March 23-25, 1941, a charge will be made for preprints of Society papers. The following schedule of prices will be in effect:

Size of papers, pages	Price per copy	
	At registration desk	By mail
12 or fewer	$0.10	$0.15
16	0.15	0.20
20	0.20	0.25
24 or more	0.25	0.30

Remittance should accompany orders which should be sent to A.S.M.E. Headquarters, 29 West 39th St., New York, N. Y.

Woman's Auxiliary to A.S.M.E. Holds Eighteenth Annual Meeting

Mrs. F. M. Gibson Re-elected President for 1942

THE eighteenth annual meeting of the Woman's Auxiliary to The American Society of Mechanical Engineers was held at the Hotel Astor in New York City during the week of Dec. 1, 1941. An interesting and entertaining program was provided by the committee with Mrs. E. C. M. Stahl, general chairman, and Mrs. J. N. Landis, vice-chairman.

On Monday a luncheon was held at the Engineering Woman's Club at 2 Fifth Ave., after which Deputy Inspector Wallender of the New York Police Department spoke on Civilian Defense, and told of his recent trip to London. In the evening the women had dinner at the Stockholm Restaurant and then attended a broadcast of "The Telephone Hour" at Radio City.

A GROUP OF THOSE ATTENDING THE TEA DANCE AT THE 1941 A.S.M.E. ANNUAL MEETING

President Parker Addresses Meeting

The annual meeting was held on Tuesday at 10:30 a.m. in the Hotel Astor. The president, Mrs. Frederick M. Gibson, presented Mr. James W. Parker, newly elected president of the A.S.M.E. Mr. Parker spoke highly of the work the women had done in the past, especially in connection with the Calvin Rice Scholarship, and expressed the hope that the Auxiliary might someday find it possible to send an American student to South America.

Reports from officers, committee chairmen, and representatives of local sections were heard. Miss Burtie Haar, chairman of tellers for the election of officers for the Auxiliary, announced the officers for the year 1942 as follows: Mrs. F. M. Gibson, president; Mrs. E. C. M. Stahl, first vice-president; Mrs. Charles Sames, second vice-president; Mrs. R. F. Gagg, third vice-president; Mrs. E. F. Zeiner, fourth vice-president; Mrs. S. F. Duncan, fifth vice-president; Mrs. P. E. Frank, recording secretary; Mrs. A. R. Cullimore, corresponding secretary; Mrs. A. H. Morgan, treasurer.

Dinner at Engineering Woman's Club

After the meeting many of the women attended the general luncheon at the Astor and heard Walter D. Binger, chairman of the National Technical Civil Protection Commission speak on "Technological Civil Protection." At 2:30 some of the women made a visit to Cooper Union while others visited Greenwich Village and the Whitney Museum. At 5:30 they met again for cocktails at the Jumble Shop on McDougal Street. Dinner was served at the Engineering Woman's Club, with bridge and other games following.

A preview of an unreleased film was seen at the Twentieth Century Fox Studios on Wednesday morning, after which the group enjoyed luncheon at Butler Hall of Columbia University. In the afternoon a visit was made to the newly dedicated Cathedral of St. John the Divine, and in the evening the women joined the men at the Banquet in the Astor.

Excursion to Downtown New York

An excursion to downtown New York, including the Federal Reserve Bank, Subtreasury Museum, and the Stock Exchange took up Thursday morning, and was followed by lunch at "Ye Old Chop House," a quaint little inn established in 1800, still retaining its original style.

The meeting closed Thursday afternoon with a Tea Dance in the Coral Room of the Astor, and all agreed it had been a most successful meeting.

Assisting the chairman and vice-chairman were: Mrs. P. E. Frank in charge of Registration; Mrs. R. B. Purdy in charge of Excursions; Mrs. C. M. Sames in charge of the Tea Dance; Mrs. A. H. Morgan in charge of Dinners.

MRS. A. R. CULLIMORE
Chairman, Publicity Committee

Wm. R. Hainsworth Elected President of A.S.R.E.

DR. William R. Hainsworth, of New York, vice-president of Servel, Inc., in charge of engineering, and national authority in the field of refrigeration research, was elected president of the American Society of Refrigerating Engineers at their annual meeting in St. Louis, Mo., during the first week in December.

A.S.M.E. Calendar
of Coming Meetings

March 23–25, 1942
Spring Meeting
Houston, Texas

June 8–10, 1942
Semi-Annual Meeting
Cleveland, Ohio

June 17–19, 1942
Oil and Gas Power Division
Peoria, Ill.

October 12–14, 1942
Fall Meeting
Rochester, N. Y.

Nov. 30–Dec. 4, 1942
Annual Meeting
New York, N. Y.

(For coming meetings of other organizations see page 26 of the advertising section of this issue)

E.C.P.D. Reports on Accrediting

ACCREDITING of 460 engineering curricula at 129 colleges and universities in the continental United States, and provisional accrediting of 102 more have been announced by the Engineers' Council for Professional Development through its Committee on Engineering Schools. The committee, of which A. A. Potter, dean of engineering, Purdue University was chairman 1939–1941, conducts the accrediting program, one of the principal activities of the Council. Inspection by the committee for the purpose of accrediting is at the request of the college or university. On request, also, the committee gives informal advice to institutions.

Since the establishment of the program in 1933, 143 of approximately 166 institutions granting engineering degrees in the United States and Alaska have submitted curricula for inspection. In 1939 the committee began reinspecting previously accredited curricula.

As of October, 1940, 459 curricula had been accredited unprovisionally; 83 accredited provisionally; 164 not accredited. During the year 1940–1941, visits were made to 26 institutions to reinspect 76 accredited curricula; to 13 institutions with one or more accredited curricula to appraise 17 nonaccredited curricula; and to 4 institutions with no previously accredited curricula to inspect 12 curricula. The status of the program, as a result of the year's work and of actions taken at the annual meeting, October 30, 1941, is as follows: Total curricula inspected, including reinspections, 896; accredited unprovisionally, 460; accredited provisionally, 105; not accredited, 167; reinspections resulting in change in status, 26; reinspections resulting in no change, 132; action pending, 6.

Among the Local Sections

Atlanta Holds Two-Part Meeting on October 20

ATLANTA section inaugurated a new type of meeting on Oct. 20 when it held a two-part session in conjunction with the Georgia Tech Student Branch. The first session was called to order at 6:30 p.m. in one of the lecture halls of the University. Henry Cates, sanitary engineer with the City of Atlanta, and Earle Connell, mechanical engineer of Robert and Company, gave a very interesting and instructive story on the new Atlanta incinerator. The second session the same night was held at 8:00 p.m. at the Atlanta-Biltmore Hotel. W. R. Chambers, mechanical engineer for the T.V.A., gave an illustrated talk on the development of steam power at various T.V.A. projects.

Bridgeport Meeting on Helicopter Attracts 125

The November 18 meeting of Bridgeport Section featured a talk by C. L. Morris, test pilot, Sikorsky Aircraft Corp., on the helicopter. More than 125 members and guests listened attentively to the speaker as he described the development of this type of aerial transportation and the many fields in which it can be used. Mr. Morris predicted that with mass-production methods it would be entirely possible to market helicopters at about $1200 each.

Buffalo Breaks Record With 335 at Meeting

Dr. Per K. Frolick and his talk on "Synthetic Rubber" at the Oct. 21 meeting of the Buffalo Section drew a capacity crowd of 335 members and guests. He stated that the country has a reserve supply of rubber enough for only 8 months and that synthetic rubber capacity will be 15 per cent of the crude rubber by the end of 1942.

Education for Democracy at Central Pennsylvania

At a combined meeting of Central Pennsylvania Section and the local chapter of the S.P.E.E. held on Nov. 14 and attended by more than 200 engineers, Dean A. R. Warnock, The Pennsylvania State College, talked on "Education for Democracy." He declared, "There is necessity for a course to educate students to appreciate the value of democracy. This will lead to better government and a real objective during the world conflict."

Motion Picture on Steel Shown to Cleveland Section

The Cleveland Section held its first Ladies' Night on November 13, with over fifty attending the dinner preceding and with about seventy-five at the meeting. An excellent film on steelmaking, "Steel, Man's Servant," done in technicolor, formed the basis of the program, with explanatory remarks by W. H. Cordes, advertising and sales promotion manager of American Steel and Wire Company. The accompanying photographs give glimpses of the enjoyable dinner party.

Time Before Clocks at Colorado

S. A. Ionides, speaker at the Oct. 24 meeting of Colorado Section, described early sundials used to tell time of day and day of year, water clocks for use at night, sun or star astrolabe used in 1540, and a slide-rule type of time unit. Slides showing the different types of early time tellers were utilized to illustrate the talk.

ANOTHER GROUP AT THE CLEVELAND DINNER ON NOVEMBER 13

(Mr. and Mrs. E. R. McCarthy, W. H. Cordes, and Miss Ziegler in foreground. Mr. McCarthy is chairman of the Cleveland Section.)

A GROUP OF THOSE AT THE DINNER OF THE CLEVELAND SECTION, NOVEMBER 13

(Lieut. E. E. Messersmith of U. S. Ordnance Department in foreground.)

November Session of Detroit on Welding

At the Detroit meeting held on Nov. 7, Dr. W. G. Theisinger, director of welding research of Lukens Steel Co., spoke on the stresses developed in welded structures and illustrated his talk with both still and motion pictures of photoelastic models. It was most interesting to the 175 members and guests to observe by means of motion-picture studies the development of stresses in these models and to be able to visualize the effects of design and workmanship upon the stresses produced in welded structures.

Florida Holds Joint All-Day Meeting With A.I.E.E.

A joint meeting of the Florida Section was held on Nov. 1 with the local chapter of the A.I.E.E. and the University of Florida Student Branches of the two organizations. Following registration at 9:00 a.m., the engineers and students heard the following talks: "Atomic Power," by J. H. Kuykendall, A.I.E.E. student member; "Large Naval Guns," by Allen A. Lang, A.S.M.E. student member; and "Production Problems of the Amphibian Tank," by J. A. Greenwald, Food Machinery Corp. Following discussion and a get-together, all adjourned to the Florida Union Annex for luncheon. In the evening, all attended the football game between the University of Florida freshmen and the Miami University freshmen.

Gear Manufacture Described to Fort Wayne Engineers

Two speakers, John Alliason and R. F. Drummond, discussed at the November 6 meeting of the Fort Wayne Section gear manufacturing problems and how some of these have been solved by a shaving process using a new-type broaching machine. The speakers had a number of charts, photographs, and samples of shaved gears as well as samples of the cutters used for the shaving operation.

REGISTRATION
A S M E

YOUR NAME, PLEASE? AT THE 1941 ANNUAL MEETING REGISTRATION DESK AT THE HOTEL ASTOR

MR. AND MRS. H. E. HARRIS VISITING THE PHOTOGRAPHIC EXHIBIT AT THE 1941 ANNUAL MEETING

President William A. Hanley Welcomed by Inland Empire

The visit of President and Mrs. William A. Hanley the week end of Nov. 15 was the occasion of considerable activity for the Inland Empire Section and the Student Branches at Washington State College and the University of Moscow. Mr. Hanley delivered three addresses in one day which he sandwiched into a 180-mile automobile trip. During the day, the wives of the members arranged a tour for Mrs. Hanley followed by a tea given at the Golf Club with Mrs. H. H. Langdon and Mrs. F. W. Candee acting as hostesses. The dinner meeting in the evening was attended by 52 members and friends, who applauded Mr. Hanley's address on "Defense—Today and Tomorrow." On Saturday, the two guests were taken on a conducted tour through the power plant now being installed at Grand Coulee Dam.

Aircraft Engineering Subject of Kansas City Session

The Nov. 14 meeting of the Kansas City Section was held at the University Club. J. C. Franklin, superintendent of engineering, Transcontinental & Western Air, Inc., was the guest speaker. His talk on "Modern Airplane Engineering and Trends of Design" was interesting as well as educational.

Modern Methods of Oil-Well Drilling at Los Angeles

Following dinner on Nov. 13, members and guests of Los Angeles Section heard several speakers describe some new methods used in oil-well drilling. T. C. Bannon described with the aid of motion pictures how a special gun can be used in perforating an oil well. D. M. Anderson discussed the electrical logging operation from the mechanical and electrical angles, the borehole information gained by the log, and recent improvements in the art of electrical logging. In a matter of one to four hours, depending on well depth, complete and reliable information can be obtained on the actual thickness of the various strata by measuring the electrical characteristics of the formation immediately surrounding the borehole. Finally, Lowell C. Beers covered the underlying principles involved in radioactivity logging through casing. It is based on the fact that the different strata have different contents of radioactive material. This new logging method allows wells to be logged that have had a casing run in them before the development of the electric log, which can be successfully run only in uncased holes.

D. B. Steinman Talks Before Metropolitan Section on Tacoma Bridge Failure

On Nov. 14, in the Engineering Societies' Building before a Metropolitan Section special meeting audience of more than 500 engineers and laymen, many of them women, Dr. D. B. Steinman, consulting engineer and internationally known authority on suspension and long-span bridges, declared that the failure of the Tacoma Narrows Bridge at Puget Sound was due to "a combination of two factors which were more marked in the design of the Tacoma span than in any other modern bridge. One was extreme flexibility of the span; and the other was a peculiar characteristic of the cross section, that may best briefly be described as *aerodynamic instability*."

The meeting, first in a series planned to be of interest to members in all Divisions of the Metropolitan Section, was in charge of Harold Carlson, chairman of the Metropolitan Section Program Committee. W. H. Larkin, chairman of the meeting, introduced the speaker.

Consultation on Priorities Held by North Texas Section

Members of North Texas Section learned about priorities at a special meeting held on Nov. 17. John Sick, Office of Production Management, gave a short talk on the history and origin of the O.P.M. and priorities. J. B. Joyce then opened the meeting for discussion. Many members had questions which were answered by Messrs. Sick and Joyce.

Story of Neoprene Given Before Norwich Section

Norwich Section at its Nov. 25 meeting featured a paper, "Story of Neoprene," by E. H. Krismann. In his talk, he discussed the development of chemical rubber here and abroad, gave comparative figures on the total chemical-rubber output as compared to natural rubber, and predicted the future output of synthetic rubber. Following the talk, a motion picture on Neoprene was shown.

President Hanley and Wife Entertained by Oregon

An informal banquet was held for President and Mrs. William A. Hanley by Oregon Section in Portland on the evening of Oct. 28. This was followed by a meeting in the auditorium of the Public Service Building at which Mr. Hanley talked on "National Defense—Today and Tomorrow." The following morning and afternoon, Mr. and Mrs. Hanley and a small group of A.S.M.E. members went on a trip over the scenic Columbia River to the Bonneville Project, where the navigation lock, powerhouse, fishways, and the dam were inspected under the guidance of a representative of the U. S. Engineers.

Philadelphia Engineers Learn Plant Protection

More than 175 members and guests of the Philadelphia Section at the Nov. 25 meeting learned about plant protection from J. F. Sears, special F.B.I. agent, and Frank Rossing, director of public safety, Pittsburgh, Pa. Mr. Sears outlined precautions to be taken by industries to combat sabotage and cited many instances to show that many cases were only the result of malicious mischief or dissatisfaction of employees. Mr. Rossing described conditions in England and admonished all Americans to prepare for what could easily happen in this country.

Providence Section Meets Jointly With Students

Meeting in Kingston, R. I., on Nov. 17 jointly with the Student Branches at Brown University and Rhode Island State College, Providence Section presented a talk by Student Member Paul Barnard on "The Panama Canal Today," and an address by Clarke Freeman, manager A.S.M.E., on "Young Engineers in National Defense."

Society Affairs Analyzed for Raleigh Section Members

Prof. A. G. Christie, past-president A.S.M.E., was the guest speaker at the Nov. 12 meeting of the Raleigh Section. He discussed the financial status of the Society and explained the present fiscal policy. Professor Christie also discussed the place of specialized societies such as A.S.H.V.E., S.A.M.E., A.S.M., A.S.T.E., and the reasons for A.S.M.E. members joining them.

Description of Alloy Cast Irons at St. Louis

St. Louis section presented Carl H. Morken, Carondelet Foundry Co., as the speaker at the Oct. 24 meeting. Behavior of cast iron without benefit of alloys was fully described first and then the reaction of cast iron when common alloys are added. Physical properties, compositions, microstructure, applications, and foundry problems were discussed by the author in the presentation of the paper.

Offset Lithography Described at St. Joseph

O. E. Zahn and Russell Miles were the speakers at the Nov. 18 meeting of the St. Joseph Valley Section. Offset lithography was the subject. Mr. Zahn gave a brief history of the process. This was followed by a running description of steps in preparing copy for reproduction as shown in a motion picture. Mr. Miles then led a general discussion on the subject.

"HOLD STILL, DADDY"

(Photograph taken by F. McCormack and shown at the Sixth Annual Photographic Exhibit, held during the A.S.M.E. Annual Meeting, Dec. 1–5, 1941, New York, N. Y. See page 65 for awards.)

Recent Aircraft Developments Outlined at South Texas

Dr. H. W. Barlow, head of the aeronautical-engineering department, Texas A.& M. College, outlined to the members of South Texas Section at their Nov. 25 meeting some recent developments in aircraft. His talk, which was illustrated by means of slides, was confined to discussion of recent developments in military aircraft, armament on same, and means for protecting the pilot and crew from gun fire.

Susquehanna Learns About Nonmetallic Protective Coats

Since chromium and nickel plating are practically out as protective coatings for metals, the members of Susquehanna Section were very much interested in the topic selected for the Nov. 3 meeting. Leo Roon told them how lacquer chemists were working out a solution. He outlined the shortages even found in the lacquer industry and discussed how the O.P.M. was cooperating in overcoming these deficiencies.

Syracuse Given Engineering Horse Sense and Other Things

More than 200 members and guests of the Syracuse Section were present at the Oct. 6 meeting to hear a talk given by Philip Swain, member A.S.M.E. and editor of *Power*, on "Engineering Horse Sense and Other Things." Among many things he said, "Engineering is based upon men and materials. Engineers must get a solid grounding of the feel of materials—grease and dirt—together with a first-hand knowledge of shopmen's viewpoints and mental processes."

Manufacture of Munitions Described to Utah Members

Utah Section members and guests were told all about the new Utah Ordnance Plant by Col. F. H. Christman on Nov. 13. This plant manufactures very large quantities of .30 caliber and .50 caliber ammunition. The material required vast amounts of powder, lead, and brass. Workers numbering 7500 to 8500 are employed in the task.

British Engineers Attend Washington, D. C., Meetings

From six to ten British engineers are always present at the periodical meetings of the Washington, D. C., Section. This was true on Nov. 13 when Lieut. Col. W. B. Burn talked on the subject of "Civilian Defense." Civilian defense plans, especially on the Eastern seaboard, were discussed. It was shown how these plans were patterned after those found so successful by the British. An invitation is issued to all A.S.M.E. members visiting the

Capital to attend the Section meetings. Definite information may be obtained by writing to M. A. Mason, 205 Raymond St., Chevy Chase, Md., or calling him on the telephone at WOodley 2863.

Air Corps Flyers Speak Before Western Massachusetts Section

Western Massachusetts Section held its monthly meeting on Nov. 18. Lieuts. John Dunham and Anthony Benevuto, Air Corps, U. S. Army, of Westover Field, with the aid of motion pictures traced the evolution of aircraft equipment and pilot training. In the discussion period that followed it was brought out that the weather is the greatest enemy of military flying, a fighter aircraft gives a bomber more concern than antiaircraft fire which is not effective at altitudes above 18,000 ft, the U. S. Army bombsight makes it possible to hit a 25-ft target from an altitude of 18,000 ft, and a direct hit on a warship is not as effective as a bomb landing near by in the water.

Waterbury Hears About Plastic Flow Theory

The elementary theory of plastic flow was explained, at the Nov. 18 meeting of the Waterbury Section by W. M. Evarts, as the slipping of crystalline planes one upon the other. Computation of true ultimate strength was shown to be a safe basis for estimating required capacity of presses for drawing or forming operations. Slides and movies of modern press equipment were shown.

Tell Berna Guest Speaker at Worcester Section

Tell Berna spoke before the Worcester Section on Nov. 12. He showed the need for the coordination of the machine-tool industry and National Defense. More than 40 members and 20 guests were present.

New Aircraft-Engine Standards Available

THE Aeronautics Division of the Society of Automotive Engineers' Standards Committee recently approved 42 new aircraft-engine standards.

The standards approved pertain largely to problems of interest to the aircraft-engine manufacturers. The range of standards included are: standard altitude graph sheets for the presentation of aircraft-engine performance, standard carburetor control connections, standard carburetor flanges, propeller-shaft ends, tachometer drives, magneto drives and mounting flanges, aircraft-engine bolt heads, aircraft-engine screw heads, aircraft-engine hexagon nuts, lockwire cotter pins, procedures and equipment for the preparation of engines for shipment and storage to prevent corrosion, standard definitions of aircraft-engine terms, as well as symbols and sketches for pressures and temperatures in an aircraft-engine induction system.

Speed Urged in Framing Standards Essential for Defense Production

L. J. Rosenwald of O.P.M. Addresses Annual Luncheon Meeting of A.S.A.

"STANDARDIZATION is going forward in this country at a rate never reached before," said R. E. Zimmerman, president of the American Standards Association at its annual luncheon meeting on Dec. 10, 1941. Three hundred representatives of trade, technical, and governmental groups who hold membership in the American Standards Association gathered at the Hotel Astor, New York, N. Y., to hear Mr. Zimmerman and Lessing J. Rosenwald, head of the new Bureau of Industrial Conservation of the O.P.M., and R. P. Anderson, chairman of the Standards Council of the American Standards Association.

All three speakers dwelt on the part that the Association is playing and can play in the country's defense program. "This entire defense effort," said Mr. Zimmerman, "has been seriously hampered by the diversity of specifications and requirements for products—acutely so in the case of strategic materials."

Speed in framing standards essential for increased defense production in the current transition from a defense to a "victory economy" was urged by Lessing J. Rosenwald, chief of the Bureau of Industrial Conservation of the Office of Production Management. Mr. Rosenwald, who is chairman of the board of Sears, Roebuck & Co., declared the economic changes which will be required are so vast that "their full scope cannot be comprehended at this time." This country, he asserted, will approach many phases of the English economy.

Warn Against Hoarding

Warning against hoarding as "unfair to the armed forces," Mr. Rosenwald touched on the differences between simplification and standardization. The former by reducing varieties, sizes, colors, etc., can increase production and cut inventory of slow-moving items, and no mechanical changes may be required. With respect to standardization, he said, new standards will undoubtedly be required, but of necessity they must be weighed carefully to determine their effect upon production.

Outlining the vast tasks which the victory program will require, Mr. Rosenwald cited the following: Tremendous increase where possible in natural resources, particularly minerals; heavy increase in manufacturing facilities through new plants and additions, transfer of civilian production to defense, squeezing out of waste, salvage and return of materials to production, increased use of substitutes, and the foregoing of luxuries and some necessities.

Commenting upon some of the work specifically dealing with defense needs, Dr. Anderson said: "Last January, the Association seeing that it would be called upon for special services, adopted a short-cut emergency method of developing standards needed for defense. This action was related to that of the British and Australian associations, both of which have been issuing defense emergency standards under a similar procedure. Four such standards have already been developed. One provides a series of tests for the accuracy of engine lathes, one of the most important tools of defense production. Two others cover control of quality in mass production. The fourth completed emergency standard sets up safe concentration limits for cadmium, which constitutes a hazard in certain defense plants. A dozen additional emergency standards are in the process of development.

"I believe that one of the most important jobs perhaps the most important job, for the Association during the coming year lies in its program of Defense Emergency Standards."

Five New Organizations Join A.S.A.

In line with the increased interest in standardization, Mr. Zimmerman welcomed five new national organizations into the membership of the Association: the American Institute of Steel Construction, the Association of Gas Appliance and Equipment Manufacturers, the National Lime Association, the Metal Lath Manufacturers Association, and the American Hotel Association.

The new members make a total of 77 national organizations holding membership.

Summarizing the work accomplished by the Association in the last 12 months, Dr. Anderson said:

"This year we have approved 130 standards plus four emergency standards developed under the short-cut procedure approved by the Standards Council last January for handling defense work. Of the 130 standards approved, 69 were new and 61 revisions of previously completed jobs. The total output of standards this year is double that of any year in our history.

"Last year four new standardization projects were undertaken. This year we have started no less than fifteen. This means that we have more than tripled the number of new projects to be undertaken as well as quadrupling the output of new standards.

First Standard in New Building-Code Program

"This year has seen approval and publication of the first standard in the new building-code program. It has also seen approval of the first standards in the field of photography. Included among the more than a hundred standards completed are a number for gas appliances, several in the toxic-dusts and gases field, a record number in the mechanical field, specifications for pigments, tests for petroleum products, and the first of a series of standards on sizing children's clothing. This record shows how the work of the Association is reaching out into new fields."

New Officers for 1942

R. E. Zimmerman was re-elected president of the A.S.A. Mr. Zimmerman, vice-president of the United States Steel Corporation, has been active in the work of the Association since 1937, when he was nominated for membership on the Board of Directors by the American Iron and Steel Institute.

Henry B. Bryans, executive vice-president and director of the Philadelphia Electric Company, was elected vice-president of the Association.

H. S. Osborne, engineer in charge of operating results of the American Telephone and Telegraph Company, was elected chairman of the Standards Council to succeed Dr. R. P. Anderson of the American Petroleum Institute.

A. W. Whitney of the National Conservation Bureau was elected vice-chairman of the Standards Council to succeed Dr. Osborne.

Cost and Performance Data on Stationary and Automotive Diesel Engines

Twelfth Year of Publication by A.S.M.E. Oil and Gas Power Division

The recently published report on Oil-Engine Power Costs for 1940 will be found a valuable source of information to Diesel operators, Diesel manufacturers, consulting engineers, oil companies, and others concerned with the operating costs of Diesel plants. This report is prepared each year under the sponsorship of the A.S.M.E. Oil and Gas Power Division by a subcommittee of which H. C. Major is chairman.

The report consists of sections on low-speed stationary generating plants, convertible oil-gas Diesel-cycle engines, and high-speed stationary generating plants.

Low-Speed Stationary Generating Plants

This section of the report presents information on performance and production costs of oil-engine power plants. Production cost as relating to plants under this section is defined as consisting of the following items: fuel cost; lubrication cost; cost of attendance and superintendence; cost of supplies and miscellaneous; cost of engine and all other plant repairs. The report includes information from 165 oil-engine generating plants, containing 472 engines, totaling 289,903.5 rated bhp. The total net output from these plants amounted to 437,619,550 kwhr.

Convertible Oil-Gas Diesel-Cycle Engines

The Committee has obtained data and costs, for the second consecutive year, from a plant containing two oil-Diesels and one convertible engine operating on gas or oil on the Diesel cycle. In view of the increasing interest in dual-fuel engines and particularly engines of the gas-Diesel type, and because of the size of the plant reported (5300 total bhp with 21,551,512 gross kwhr generated in 1940), the Committee considered the report of enough significance to warrant a special tabulation, which is included under the section entitled, "Convertible Oil-Gas Diesel-Cycle Engines." It is reasonable to expect that other plants containing convertible Diesel-cycle engines can be added to this section in the future.

Automotive Diesel Engines

The Committee presents its second annual report on performance and operating costs of Diesel engines used in automotive equipment, particularly in the bus and truck field. Revised questionnaire forms were mailed to approximately 250 vehicle operators. Over twenty reports were returned, and of these fifteen submitted data in detail sufficient for tabulation. This tabulation, containing data on 452 Diesel-powered vehicles of various types, is presented in the report under the section, "Automotive Diesel Engines." This year's report contains data on more than twice the number of vehicles reported on in 1939. It is reasonable to expect that this section can be still further enlarged in future reports.

Copies of the report are obtainable from the A.S.M.E. Publication-Sales Department, price $1.25; to A.S.M.E. members, $1.

Young A.S.M.E. Members in U. S. Army Are Eligible for Officers' Schools

War Department Circular No. 245—1941 Explains Qualifications

Many Juniors of the A.S.M.E. have been inducted into the U. S. Army who are eligible to become candidates for the Officer Candidate Schools which are now set up to train in all services and branches approximately 3500 students every three months. The required qualifications, education, application form, and method of selection are described fully in Circular No. 245 issued by the War Department on Nov. 26, 1941.

According to the instructions, officer candidates, in order to be accepted as such, must have demonstrated outstanding qualities of leadership during their period of service in the Army, which shall be not less than four months. Those with a B.S. degree in electrical and other engineering from an accredited college or university are eligible for admission to the Signal, Engineer, Ordnance, Quartermaster, Finance, or Medical Administrative Schools. An applicant may designate a preference for an alternate arm or service other than those to which he is assigned provided that vacancies exist in the alternate branch and the soldier possesses the necessary educational requirements. Candidates must be not less than 21 nor more than 28 years of age on date of termination of the course.

Candidates undergoing training at replacement training centers must have a minimum of four months of continuous active service immediately preceding the date of the opening of the course for which selected. All other personnel must have a minimum of six months of continuous active service.

N.E.M.A. Publications Announced

N.E.M.A. announces the publication of a new handbook entitled "Turbine Generator Recommended Practices."

The practices contained in this publication were compiled to cover direct-connected sets and 25-cycle and direct-current geared sets in types and sizes in current use. The material is divided into three separate classifications as follows: Turbine units, synchronous generators for steam-turbine drives, direct-current generators for steam-turbine drives.

N.E.M.A. also announces the release of a new edition of the Large Air Circuit Breaker Standards, superseding publication No. 37-43.

This standard contains thirty pages of information inclusive of commercial standards, general standards, definitions, and instructions for the installation, operation, and care of large air circuit breakers.

It also contains application standards for large air circuit breakers and rating and manufacturing standards for both large air and enclosed air circuit breakers.

Copies of both of these publications are available from N.E.M.A. Headquarters, 155 East 44th Street, New York, N. Y.

Motion Pictures on the Operation of a Lathe

To speed up the training of lathe operators for national-defense industries, the South Bend Lathe Works has sponsored the production of a series of 16-mm sound motion pictures in full color based on the book, "How to Run a Lathe." Professionally filmed by Burton Holmes Films, Inc., at the South Bend lathe factory, these pictures show practical shop methods as practiced in modern industrial plants. Showing time for each 800-ft reel now completed is approximately 20 min.

The first reel entitled "The Lathe" clearly shows the apprentice what a lathe is, what a lathe is for, and how the various parts operate. Important lathe operations, including turning, facing, and thread cutting, are demonstrated. The second reel, "Plain Turning," shows in detail each operation performed in the machining of a straight cylindrical shaft between the lathe centers. Close-ups show locating and drilling of center holes, adjustment and setting of cutting tools, use of cross-feed graduations, use of calipers and micrometers, use of quick-change gearbox, changing speeds, and operation of the lathe carriage and apron.

Factory apprentice schools, vocational schools, Army and Navy training schools, colleges, and high schools teaching machine-shop practice will find these films helpful. Complete information on securing the use of these films can be had by writing to South Bend Lathe Works, Dept. 6M, South Bend, Ind.

United Engineering Trustees, Inc., Renders Annual Report for 1940-1941

Summary of Facts Concerning Personnel, Building, Finances, Engineering Societies Library, and Engineering Foundation

THE Annual Report of the United Engineering Trustees, Inc., for 1940-1941, was issued on October 23, 1941, by President Henry A. Lardner, fellow A.S.M.E. Mr. Lardner's report in somewhat abridged form follows:

Any record of business in the last year, the thirty-seventh year of the Corporation, should refer to contemporary conditions which affected it. The second World War which has been in progress and now threatens us, makes us all conscious of scarcity of materials and of rising prices. Governmental control has increased. Markets have been uncertain. Management has risen to the new conditions and we have been conscious of immediate improvement in business, at the same time planning a future based on more normal conditions. The demand for technically trained men in normal and defense industry, and those called to army and navy service, has been felt by all our societies.

Personnel

Before dwelling on the work of the Corporation, we must record with deep regret, the death on April 15 of our esteemed fellow Trustee, Otis Ellis Hovey, director and member of The Engineering Foundation and formerly on the Library Board, for many years Treasurer of the American Society of Civil Engineers, and active in engineering interests and committee work. His kindly personality, his alert interest, and his geniality made him greatly beloved by all who knew him.

Former Trustees who were widely known for their important works and who passed away during the year were Lincoln Bush, Lewis Butler Stilwell, Arthur W. Berresford, and Bancroft Gherardi. These men contributed in great measure to the advance of our civilization. Although retired, they had been active without thought of reward, and their loss is keenly felt.

Financial

A review of the financial transactions during the last year shows a constant scrutiny of the portfolio by the Finance Committee, with helpful information and guidance by the Financial Counsel and the Investment Adviser. Replacement of certain securities improved the position of the portfolio and in some cases increased the return, maintaining the policy of safeguarding the principal while obtaining the most income possible for the conduct of Engineering Societies Library and the research work of the Engineering Foundation. All securities now are in the custody of the Chemical Bank and Trust Company, Customers' Securities Department.

The Depreciation and Renewal Fund for Engineering Societies Building on September 30, 1941, totaling $452,322.15, received its usual accretion of $20,000 and interest on its investments. During the summer months renewals were necessary which were properly financed from this fund.

Haskins & Sells, certified public accountants, audited the books of the Corporation. Their certificate is included in the financial report. The Corporation is treasurer for the Engineers' Council for Professional Development, and custodian of funds for Engineering Societies Personnel Service, Inc., Relief Fund, and of the John Fritz Medal Board of Award and the Daniel Guggenheim Medal Board of Award, also of contributions for specific researches by the Engineering Foundation.

Engineering Societies Building

It will be recalled that a year ago we had a detailed report on the Engineering Societies Building made by firms of architects and real-estate consultants. Many of their suggestions were necessarily rejected from immediate consideration but others were carried out for the convenience and comfort of the occupants. During the year, we have changed the building from direct to alternating current and have improved illumination in the Engineering Societies Library by the use of modern fluorescent luminaires. Some of the Societies have taken advantage of this new light. On several floors with large personnel, changes have been made in elevator doors to expedite traffic. Changes have been made on one floor to provide a greater number of offices. Structural and equipment repairs were made and it is a pleasure to report that safety and fire-insurance inspections find the building in excellent physical condition. It is adequately covered by fire, liability, and compensation insurance. The property is tax-exempt. All space in the building is occupied for the purposes for which intended, by Founder Societies and Associates. We have cooperated with governmental agencies by providing assembly space for military and educational meetings.

We referred last year to the clause in our Charter which requires us to use "perpetually" as a meeting place and headquarters, any building erected by the Corporation. The binding language prevents us from acquiring new property or rebuilding on the old. With no immediate prospect for any action, but in order to be prepared to take advantage of any future opportunity, we have received the approval of the four Founder Societies to apply for an addition to our Charter which would enable us to acquire a new home should this become desirable. This application will be presented to the next legislature.

On December 2, a special meeting of the Corporation was held in the lobby of Engineering Societies Building at which time, in conjunction with The American Society of Mechanical Engineers in annual meeting, a memorial tablet was installed in a prominent position in honor of Calvin Winsor Rice who with Dr. Charles Felton Scott, was largely instrumental in interesting Andrew Carnegie in providing Engineering Societies Building as a "union home" for the engineering societies. Dr. Scott recounted interestingly on those

SUMMARIZED FINANCIAL REPORT, SEPTEMBER 30, 1941

FUNDS AND PROPERTY

Combined Fund:* Summary of Investments September 30, 1941

FUNDS INCLUDED		Book value	Market value
Engineering Foundation Fund		$ 887,180.97	
Edward Dean Adams Fund		90,031.62	
Library Endowment Fund		166,717.51	
Depreciation and Renewal Fund		452,322.15	
General Reserve Fund		10,094.90	
Total		$1,606,347.15	
Investments: "Legal"	$ 423,197.97		
Nonlegal	1,018,951.28		
Total Investments Sept. 30, 1941	1,442,149.25		$1,321,888.97
Cash uninvested	44,785.82		
Savings Bank Accounts	119,412.08		
	$1,606,347.15		
Real-estate		$1,993,793.92	
Henry R. Towne Engineering Fund Investments		39,133.13	24,104.62
Henry R. Towne Engineering Fund Uninvested Cash		5,671.30	
The Daniel Guggenheim Medal Board of Award Investments		15,604.28	7,412.38
The Daniel Guggenheim Medal Uninvested Cash		235.72	
The John Fritz Medal Board of Award Investments		3,500.00	3,893.75
United Engineering Trustees, Inc., Operating Assets		7,572.17	
Engineering Societies Library Maintenance Assets		18,941.24	
Gift for Endowment Committee Cash		474.94	
The Engineering Foundation—unexpended income		22,078.96	
Alloys of Iron Research—unexpended income		4,087.18	
Welding Research—unexpended income		4,447.11	
The Engineering Foundation Custodian Fund Cash		10,723.96	
United Engineering Trustees, Inc., Custodian Funds—unexpended income		2,170.64	
		$3,734,781.70	

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* A group of funds managed as one for convenience and economy in investment transactions.

early days of the societies and the profession, and Dr. Rice's successor as secretary of The American Society of Mechanical Engineers, Colonel C. E. Davies, unveiled the memorial.

Special Committees

Committees of the Corporation which have performed highly useful functions in studying courses of action are the Fund Raising Investigation Committee and the Committee to Review Pension Plans. Both of these committees have reported to the Board and action is pending.

Other committees whose work has been most helpful are the Committee for Liberalizing the Charter and the Committee to investigate matters of mutual interest with the Engineers' Club.

Engineering Societies Library

The annual report of the Engineering Societies Library was published in MECHANICAL ENGINEERING for December, 1941, page 930.

The Engineering Foundation

The Engineering Foundation, established in 1914, completed its twenty-seventh fiscal year on September 30, 1941.

The policy of making relatively small appropriations to a considerable number of projects in diverse fields of engineering was continued. In all cases these projects had the approval of one or more of the Founder Societies, and in most cases they had additional support from societies or from industry. The Foundation has thus been able to promote research to a greater degree than would be possible were only the direct support of the Foundation involved.

During the year, work has progressed on thirteen projects, comprising thirty-four separate problems, including the following in which the A.S.M.E. is particularly interested:

Critical Pressure Steam Boilers: Project 50. Grant, $1000. Chairman, Prof. H. L. Solberg, Purdue University, West Lafayette, Indiana.

Corrosion Studies: Intermittent cooling tests were carried out for a total time of exposure of 1100 hours with steam at 1200 F. The results indicated higher rates of corrosion with intermittent cooling than with steady temperature operation for the same total time. The thick coating of scale on the $^1/_2$-in. round bars of low-carbon-steel specimens did not spall very much but the oxidation products did not give effective protection to progressive oxidation. The tendency of the scale to spall increased markedly with increase in chromium content up to 4–6 per cent chromium. The 9 per cent chromium specimens showed no evidence of spalling, even under microscopic examination, and also had very low rate of corrosion.

As a further check, 14 different steels containing varying amounts of chromium, silicon, and aluminum, some stabilized with columbium, were subjected to a 1300-hour test at 1200 F with rapid cooling to room temperature at the end of 500, 600, 700, 800, 900, 1000, and 1150 hours of total time. Specimens were made by splitting longitudinally into two equal parts, $1^1/_2$-in. OD and 1-in. ID seamless steel tubes each 4 in. long, and machining three flat spots on about 40 per cent of the external surfaces. This gave specimens having convex, concave, and flat surfaces on each specimen. The results confirmed those from the preceding test which indicated that the scale became more brittle and susceptible to spalling as the chromium content increased to about 4–6 per cent, but that steels containing 9 per cent or more of chromium produced thin, adherent scales which would not crack under the test conditions. The effect of additions of silicon and aluminum were also determined.

Tests have been completed on cast-steel specimens supplied by the Crane Company in order to determine their resistance to corrosion by high-temperature steam. In general, the data indicate that the corrosion of cast-steel specimens is not materially different in amount from the corrosion of rolled-steel samples.

A special test was conducted at steam temperatures up to 1400 F in order to observe the corrosion of the high-chromium steels. Steels having 7 per cent chromium or more showed very little corrosion.

A complete report covering the work accomplished during the last four years, on the corrosion of unstressed steels and various alloys, will be published soon.

In addition to the grant from the Foundation, acknowledgment is made of the cooperation of the United States Naval Research Laboratory, which has made possible the construction of apparatus for further tests to be reported later.

Viscosity Studies: The apparatus used to measure the viscosity of superheated steam has been modified and recalibrated and is now being used to measure the viscosity of nitrogen under various pressures and temperatures.

Fluid Meters: Project 30-b. Grant, $2000. Chairman, R. J. S. Pigott, Gulf Research and Development Company, Pittsburgh, Pennsylvania.

The grant from the Foundation for the reported year was allocated to the research on volumeters which was begun the preceding year. An extensive program of research on this type of meter has been laid out and a campaign inaugurated to secure from industry the funds and equipment necessary to carry it forward. Meter manufacturers have shown their interest by lending meters of various types to be used in tests. A subcommittee has been formed, in the Southwest among the oil producers, which is expected to advise on field tests and to aid in obtaining funds to finance such tests. The program is already functioning and tests are being made at the University of Oklahoma by Professor Ambrosius, on thirty meters. The meters will be tested with two grades of oil at the University, and then shipped to Annapolis to be run on gasoline at the Naval proving station. These tests on oil and gasoline will supply data on the effects of viscosity and lubricity and after their completion the meters will be returned to Oklahoma for installation in the field so that "wear tests" may be made under service conditions.

Rolling of Steel: Project 68. Grant, $400. Chairman, Dr. A. Nádai, research professor at the University of Pittsburgh, Pittsburgh, Pa.

Cold Rolling of Steel: The Foundation's grant for 1940-1941 was used entirely for this particular problem, and the work was carried on at the Massachusetts Institute of Technology under the supervision of Prof. C. W. MacGregor.

A series of rolling experiments was completed on mild steel and copper, and carried out as originally planned. Both motion pictures and still photographs were made of the mechanism of deformation in 1-in. square bars of these materials which were cold-rolled between 6-in-diam rolls. Some of the steel and copper bars having highly polished surfaces were rolled at various percentage reductions without lubrication and the flow layers photographed by means of the plastiscope. Most of the tests were carried out on the soft copper bars in order to simulate billet rolling of steel at high temperatures. Both rectangular networks and circular engravings were used in the sides of the bars in order to measure the strains in the plastic regions. Some of the bars were then rerolled in the same direction, and others in the reverse direction, to study the effects of the direction of rolling on the deformations. In each case, the bar was stopped part way through the rolled length and the strains measured before continuing.

A brittle lacquer was also tried in order to determine the direction and magnitude of the elastic strains ahead of the rolls. This gave some indication of the strains in the elastic regions while the networks and the engraved circular markings determined the strains and their directions in the plastic regions.

Cottonseed Processing: Project 52. Grant, $1000. Chairman, Dean W. R. Woolrich, University of Texas, Austin, Texas. Robert Brooks Taylor, in charge, at the University of Tennessee, Knoxville, Tennessee.

In addition to the continuation of the problems in cottonseed processing, a new experiment in decortication of cottonseed by steam explosions was started in 1940-1941, half of the Foundation's grant having been allocated to this work.

Several other organizations cooperated. No progress report for the fiscal year is as yet available.

Two A.S.M.E. Members Make Gifts to Society

AT THE concluding meeting of the 1941 Council on Friday, December 5, the Secretary announced that he had just received word from W. D. Ennis, Treasurer, that an anonymous gift of $1000 had been made to the Society. The donor made no stipulation as to how the gift was to be used.

Announcement was also made at that time of a gift of $500 from John Knickerbacker, a member of the Society since 1891.

The Council voted formally to receive these gifts with sincere appreciation.

With the Student Branches

Hundreds of Student Members Attend Luncheon Held During Annual Meeting of A.S.M.E.

Student Awards Made to Recipients and Talks Given by President W. A. Hanley and President-Elect J. W. Parker

WILLIAM B. BURLINGAME AND HIS HIGH-SCHOOL GUEST

(Mr. Burlingame of Exeter, N. H., brings a student guest to every Annual Meeting. This time Hunter Lees came along.)

IN ACCORDANCE with a tradition established several years ago, Wednesday, Dec. 3, was designated as Student Day at the 1941 Annual Meeting of The American Society of Mechanical Engineers, held in New York City, Dec. 1–5, 1941. The main event of the day was the Student Luncheon which was attended by more than 300 student members and members of the Society who have distinguished themselves in their particular fields of mechanical engineering.

Eugene W. O'Brien, chairman of the Committee on Relations With Colleges, acted as toastmaster. He introduced the recipients of 1941 A.S.M.E. student awards; and then President William A. Hanley; James W. Parker, president-elect; Professor N. C. Ebaugh, Joseph W. Roe, and H. E. Degler; Harte Cooke, chairman of the Old Guard Committee; L. Austin Wright, secretary of The Engineering Institute of Canada; Brig. Gen. G. M. Barnes, Ordnance Department, U. S. Army; Secretary C. E. Davies; and J. H. de Medeiros, of Brazil, S. A., who is studying at R.P.I. on a scholarship awarded to him by the Woman's Auxiliary to the A.S.M.E. from the Calvin W. Rice Scholarship Fund.

Presentation of Student Awards

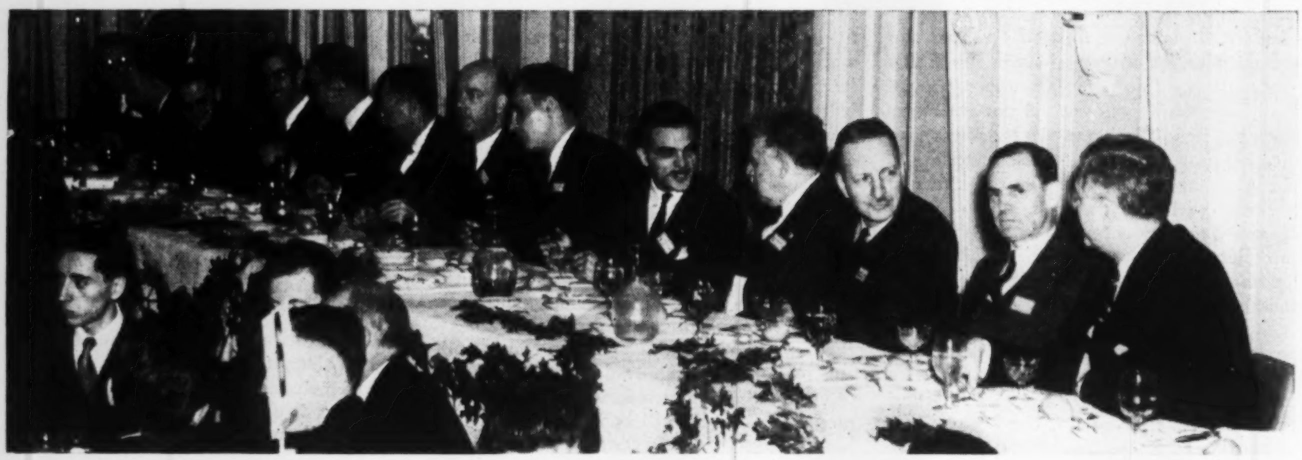
Mr. O'Brien announced that the recipient of the 1941 Undergraduate Student Award, G. Walker Gilmer, 3rd, graduate of the University of Florida and junior engineer with Pan American Airways System, was unable to be present because he was on his way that day on a Clipper airplane to Africa to help in the servicing of military aircraft ferried to that continent over the Atlantic by his company. Mr. Gilmer had received his award the day before for his paper, "Center of Pressure Characteristics of a Marconi Yacht Sail."

The winner of the Charles T. Main Award for 1941, John J. Balun, graduate of the University of Detroit and student engineer with the General Electric Co., Schenectady, N. Y., was given his prize by President Hanley which he won for writing the best paper on "The Need and Possibilities of Participation by Engineers in Public Affairs." Professor Degler, national secretary of the honorary mechanical-engineering fraternity, Pi Tau Sigma, presented the 1941 Pi Tau Sigma Award recipient, R. Hosmer Norris, engineer in the engineering laboratory of General Electric Co., Schenectady, N. Y., to President Hanley, who gave him a certificate and gold medal "for outstanding achievement in mechanical engineering, particularly in the heat-transfer field."

Hanley and Parker Speak

This was followed with brief talks by Dr. Hanley and Mr. Parker. The President said that on his recent 27,000 mile trip through the United States, he found some confusion among the younger men as to whether there would be any engineering in the future. As long as there were student engineers and young engineers left, he stated, engineering would exist in old and new forms. Such large companies as United States Steel, Consolidated Edison Co., and others would still depend on engineers. Many new fields are opening up: aviation, aluminum, air conditioning, and prefabricated housing. There will be new forms of energy to discover and new fields to conquer. The same old rules, such as study, character, personality, will hold. In conclusion, Dr. Hanley asked the young men to carry on the objectives and aims of the Society when they got ready to take over. In the meantime, today's engineers stand ready to guide and advise them.

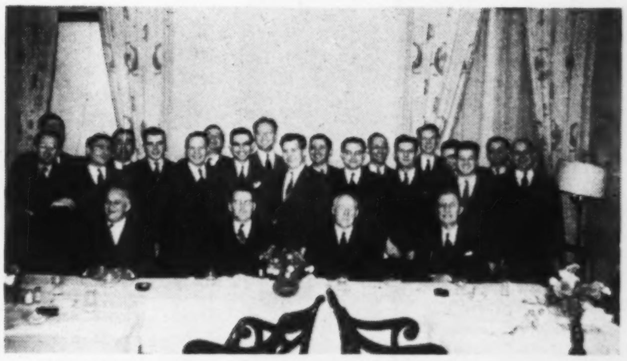
Mr. Parker was also very brief and to the point in his address. After an engineer passes a certain period in life, he explained, he wants to become acquainted with younger ones so that he can pass on to them his knowledge, experience, and methods. Mr. Parker suggested that all present attend not only the technical sessions but also the committee meetings to observe the workings of the A.S.M.E. and find out what a job it is. National engineering societies, such as this, are the medium whereby



THE SPEAKERS' TABLE AT THE STUDENT LUNCHEON

(Left to right: N. C. Ebaugh, Joseph W. Roe, H. E. Degler, R. H. Norris, President Hanley, E. W. O'Brien, President-Elect Parker, J. J. Balun, J. H. de Medeiros, Harte Cooke, L. Austin Wright, Brig. Gen. G. M. Barnes, and C. E. Davies.)

W. H. CARRIER WITH STUDENT MEMBERS AT LUNCHEON



NEW YORK UNIVERSITY ALUMNI GROUP DINNER

TUFTS DELEGATION AT ANNUAL MEETING

(This was the largest out-of-town student group attending the Meeting. While the senior mechanical-engineering class at Tufts numbers but 25, the group coming from Boston was 41, five of whom were faculty members, they stayed for the whole convention.)

ANOTHER GROUP AT THE STUDENT LUNCHEON AT THE ANNUAL MEETING

(Left to right: W. Van Stone, Newark College; H. Emery, Tufts; Jeanne Chandler, Purdue '40, now with the Public Service of New Jersey; and D. L. Arm, Mem. A.S.M.E.)

the younger engineer can learn from the experience of the older engineers, he stated. Finally, he admonished the student engineers, above all things, to be tolerant.

Norris Presents Paper

The concluding item on the program was an address by Mr. Norris, who talked on "Heat-Transfer Surfaces—Some Economical Configurations." With the aid of slides, he showed how a study of various types of heat-transfer surfaces made possible an efficient type and, at the same time, a more economical one because of the less material required.

Branch Meetings

Arizona Holds Dinner Meeting

ARIZONA BRANCH held a dinner meeting on Nov. 12 for all mechanical-engineering students in the school. Short extemporaneous talks were given by Robert Stevens, H. B. West, Ray Weaver, Al Diehl, and Robert Stevenson. In conclusion, it was announced that since Hilton DeSelm had been voted the most outstanding mechanical-engineering student for the last year, his name would be added to those already engraved on a plaque which hangs in the engineering school.

Akron Branch reports holding the first meeting of the year on Oct. 16. F. R. Brown, chairman of the Branch, presented the honorary chairman, Prof. Fred S. Griffin, who gave a talk on the history and aims of the A.S.M.E.

Arkansas Branch held a meeting on Nov. 21 which was attended by 30 members. Three talks were given by student members. The most interesting one was that by Austin Bacher, who talked on "Airplane Wings."

British Columbia Carries on

Now that the United States is at war, the Student Branches in this country can well follow the example of British Columbia Branch which is carrying on with interesting meetings, many of the papers being given by the student members themselves. At meetings held on Oct. 23 and 30, and Nov. 13, papers presented included "C.P.R. Locomotive No. 8000," by Norman Bruce, "Paper Machines," by Sid Rooney, "Pipe Bends," by Earl Johnson, "Airscrews," by William Hunt, "Coke-Ammonia Process," by Harold Coverdale, and "Steel-Concrete Pipes," by Harold Lear.

Bucknell Branch reports holding the first meeting of the semester on Sept. 26. Application blanks were passed out, pep talks given by the officers, and a date set for the next meeting.

California Tech Branch held its first meeting on Oct. 10. More than 50 new members applied for membership at this time.

Case Branch held a special meeting on Nov. 12 at which two sound motion pictures by the N.A.C.A. were shown. The first, "The Fundamental Nature of Air Flows and Air Separation," demonstrated the flow of air around airfoils by means of smoke flow. The second was a slow-motion study of normal combustion, preignition, and knock in a spark internal-combustion engine.

120 Attend C.C.N.Y. Meeting

William Hargest, member A.S.M.E. and associate editor of *American Machinist*, spoke on jigs and fixtures before 120 members and guests of the C.C.N.Y. Branch at the Nov. 6 meeting. He pointed out that jigs enable semiskilled workers to do accurate and rapid work on airplane structures. The talk was concluded with the showing of a motion picture on the Bell Aircobra warplane in action.

Colorado Branch met on Nov. 12 and heard Dr. William B. Pietenpol give a talk on "Taking the Cream Off Engineering." The regular business part of the meeting was then held, followed by refreshments and a general get-together.

Cooper Union Branch at its meeting on Nov. 19 had an address by Dean George F. Bateman on the advantages of mechanical engineering. A film, "Army on Wheels," describing the mechanization of the U. S. Army, was shown next. A second film, "Thrill Hunter," showed the tricks that Jimmy Lynch of World's Fair fame can do with automobiles.

Harte Cooke at Cornell

Harte Cooke, Fellow A.S.M.E. and past vice-president of the Society, is in charge of the special course in Diesel engines being given to a group of naval ensigns in training at the University, reports Cornell Branch. More than 90 members and guests turned out

THE COOPER UNION DYNAMOMETER QUARTET

(So named because the group has always rehearsed in the shadow of a dynamometer in the mechanical-engineering laboratory of Cooper Union. They rehearse weekly before dinner; their favorite composer is Mozart. Reading from left to right are W. E. Brown, civil engineer; E. A. Salma, mechanical engineer, and honorary chairman of the Evening Division Student Branch of the A.S.M.E.; E. W. Starr, electrical engineer; and H. F. Roemmele, mechanical engineer.)

on Oct. 21 to hear him talk before the Branch on the early history and development of Diesel engines. Numerous slides of Diesels in various types of installation and service were shown and explained. He told how Germany is conducting research in aircraft Diesel engines because of her shortage of aviation gasoline.

Duke Branch at its Oct. 29 session followed a brief business session with the motion picture, "Wright Builds for Air Supremacy," showing the manufacture of aircraft engines.

Florida Section presented two student papers at the Nov. 14 meeting. Al Schmidt spoke on "Condenser Tube Cleaning and Heat-Transfer Control," and Frank Gagliardi discussed "The Post Office Department."

Idaho Branch featured talks by student members at the Nov. 13 session. Eldon Cunningham discussed the Snoqualmie Falls Power Plant, where he was employed during the last summer. This power plant is quite unique since the generating room is 270 ft below the surface of the ground in a room hollowed out of basaltic rock. Elwood Cone gave a talk on the Rock Island hydroelectric plant which was the first major power project developed on the Columbia River. The meeting was concluded with a discussion about holding an indoor picnic in the mechanical-engineering laboratory.

Illinois Branch Loses

The local chapter of the A.I.E.E. won a quiz contest from the A.S.M.E. **Illinois Branch** on Nov. 5 by the close score of 2197.5 to 2137.5. As a token of their victory, the electricals received the "Buck" Knight trophy which consists of a thimble, signifying industry, a collar button, signifying eternal search, and a pair of wire handles, representing adaptability. The quiz master was Prof. H. E. Babbitt. More than 150 members of both societies were present for the event.

Iowa State Branch on Nov. 12 learned about the plants visited on a senior inspection trip to Milwaukee and Chicago from Gibbs Raetz and Don Eby. This was followed by a motion picture showing the manufacture of airplane engines.

Iowa Branch devoted its meeting of Nov. 5 to student talks. Alward explained the purpose and organization of the A.S.H. & V.E., Brombaugh spoke about wind tunnels, and Anthony described the electron microscope.

Kansas Branch members learned about the manufacture and uses of wire rope from John Voigtlander, chief engineer of the Union Wire Rope Co., at the Oct. 30 meeting. Also discussed were wire-rope lubricants, drawing of rope, and wire cables for bridges.

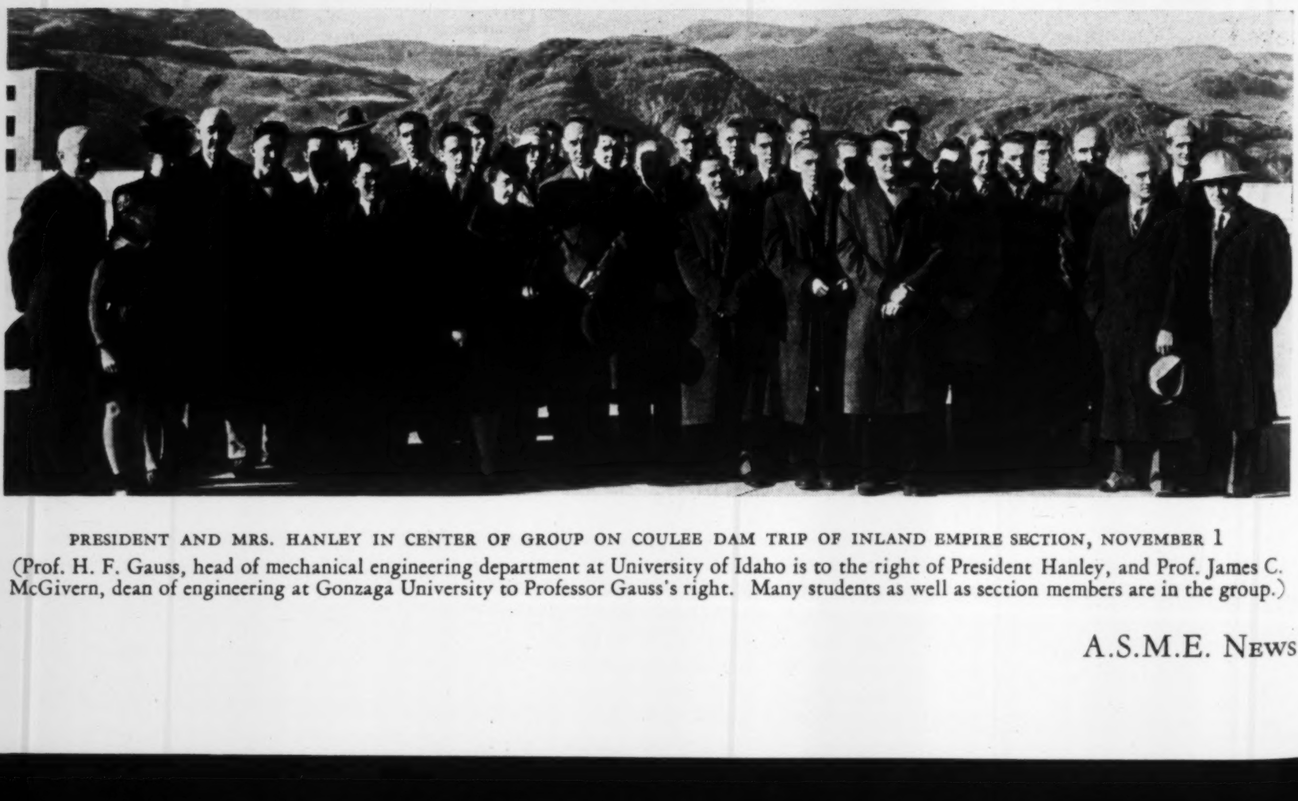
Kentucky Branch at the meeting on Oct. 31 had a motion picture on "Glass-Blowing Technique." The film showed how this method is used for making various articles for laboratory use.

Maryland Branch had 12 members and 64 prospective members at the Oct. 1 session which was the first one of the year.

Safety Glass at Michigan

The main part of the Nov. 19 program of the **Michigan Branch** was a lecture on safety glass by O. G. Rugg, Ford Motor Company. He accompanied his comments with numerous demonstrations on various samples of glass he had brought with him. His talk began with a short history of glass manufacture and included a brief but adequate explanation of the latest manufacturing methods.

Missouri Mines Branch had as guest speaker at the Nov. 4 meeting the director of the O.P.M. in St. Louis, Lieut. Col. Carter C. Bliss. He gave a talk on the problems and



PRESIDENT AND MRS. HANLEY IN CENTER OF GROUP ON COULEE DAM TRIP OF INLAND EMPIRE SECTION, NOVEMBER 1

(Prof. H. F. Gauss, head of mechanical engineering department at University of Idaho is to the right of President Hanley, and Prof. James C. McGivern, dean of engineering at Gonzaga University to Professor Gauss's right. Many students as well as section members are in the group.)

A.S.M.E. STUDENT BRANCH AT THE UNIVERSITY OF NEBRASKA

processes of steel casting and the problems solved by the O.P.M.

Nebraska Visits Bomber Plant

On Oct. 29, **Nebraska Branch** visited the new bombing-airplane plant in Omaha where they were conducted through the plant by Major Fitzpatrick. The type of plane that is to be built at this plant is the medium bomber. The expected production is three craft a day, with one out of every ten being tested at the field adjoining the plant.

New Mexico Branch held a meeting on the evening of Nov. 11 at which the speaker was Hugh Munn, teacher of defense classes at the University. He urged all the student members to make full use of the time they spend in college because the engineer of tomorrow will be the man who will reconstruct the world after this present war is over.

N.Y.U. **Branch** (aeronautical) on Nov. 19 had a talk by Thomas P. Lombardo, student member, on the use of "anolin" in stepping up the octane rating of gasoline. The mixing ratio is six gallons of the chemical to 100 gallons of ordinary aviation gasoline and is used whenever the engine is under excessive strain. Addition of anolin raises the octane rating and relieves the strain on the engine thereby preventing overheating and excessive wear of parts.

N.Y.U. **Branch** (mechanical) members heard an interesting talk on marine engineering given by Prof. John Labberton, member of the faculty, at the Nov. 26 meeting.

Prof. Christie at N. C. State

The **North Carolina State Branch** held a joint meeting with the local chapter of the I.Ae.S., and showed motion pictures on the manufacture of aviation engines. Following the show, Prof. A. G. Christie, past-president of the A.S.M.E., gave a talk on "Creative Engineering."

Northeastern Branch members at the Nov. 6 meeting heard a discussion of "The Supercharger and Its Applications" by Raymond Bean, chief of maintenance for E. W. Wiggins Airways, Inc. He brought with him many of the parts used with the supercharger to demonstrate his talk.

Ohio State Branch secretary Elizabeth Izant reports that at the Oct. 31 meeting the Speaker was Professor Rowntree of the economics department who described with the aid of colored pictures his recent trip through western United States and Canada.

Oklahoma Branch has a custom which may well be adopted by other branches. At the beginning of the year, all members are required to stand and introduce themselves just before the start of the meeting. This was done at the Oct. 30 meeting which featured the showing of two motion pictures. The first was "The Theory of Flight" and the second was "Problems of Flight."

Pennsylvania Branch was told of engineering mistakes by Max Fiedler, of the Fiedler-Sellers Corporation, at the Nov. 3 meeting. He pointed out that more knowledge can be gained through making mistakes than any other way.

Pittsburgh Features Student Papers

The year's program of senior talks before the **Pittsburgh Branch** was begun at the Oct. 30 meeting. William Gray spoke on "Student-Instructor Relations in the C.A.A. Program," and Theodore Just outlined the mechanics of the air-mail pickup service inaugurated in Pennsylvania and West Virginia some three years ago. At the Nov. 6 session, C. William Sidwell explained the physical characteristics and performance ratings of the new Waukesha-Hesselman engine now on order for the internal-combustion-engine laboratories of the University. Campbell Yates read a paper on "Flutter and Vibration in Aircraft Structures."

Purdue Welcomes J. W. Parker

More than 400 members and guests of **Purdue Branch** were present at the Nov. 14 meeting to welcome James W. Parker, president-elect of the A.S.M.E. His talk on "Attack on Bewilderment" dealt with the value of an engineering education as an aid in the solution of problems of everyday life as well as engineering problems. Following the meeting, Mr. Parker was the guest of honor at a luncheon in the Memorial Union.

R.P.I. **Branch** at the second meeting of the year on Oct. 28 showed a film on the fabrication and assembly of aircraft engines.

AT THE STUDENT LUNCHEON—BUT NOT STUDENTS

(Left to right: A. L. Kimball, Joseph Pope, E. J. Billings, A. R. Mumford, G. A. Stetson, S. W. Dudley, L. S. Zsuffa, and K. J. Moser.)

RICE BRANCH has been holding some very interesting meetings. At the Oct. 29 session, Lew Roberts, personnel manager of the Houston Shipbuilding Corporation, reviewed the labor situation at his company. He explained that through the training program at the plant, graduate engineers could be trained in three months for jobs that had required at least three years of experience before the lesser educated man would be termed skilled at his work. On Nov. 19, Thomas Mobley, Hughes Tool Co., explained the difficulties and problems with which a personnel department deals. The general impression gained from the talk was that the change in relations between labor and capital is for the best.

U.S.C. **BRANCH** gave out questionnaires at the Nov. 4 meeting inquiring as to the experiences or hobbies of members which would be suitable for student competition.

SOUTH DAKOTA STATE BRANCH held a joint meeting with the A.I.E.E. chapter on Nov. 19. Two motion pictures, "G.E. Workshop" and "There's a Difference," were shown.

Texas Has Faculty Talks

With a group of distinguished engineers on the faculty, **TEXAS BRANCH** does not have to go outside to obtain speakers. On Oct. 27, Chapin W. Yates, research assistant, discussed the use of lignite as a fuel. On Nov. 10, Prof. M. J. Thompson gave an interesting discussion on "Current Problems in the Aeronautics Industry." At the Nov. 17 session, Dean W. R. Woolrich talked on the subject of "Engineering—Yesterday, Today, and Tomorrow."

TEXAS A.&M. BRANCH had a turnout of 230 for its meeting of Nov. 6. The first part of the program consisted of a motion picture showing the manufacture of airplane engines. This was followed with a talk by Harold Ramsden on a new type of cargo vessel, "Sea Otter II," developed by engineers to relieve the present shortage of freight boats.

TEXAS TECH BRANCH's program for the Nov. 17 session consisted of a talk by John Hebrank, industrial-engineering department, on his work while at the Vega Aircraft Company.

Boats Described at Tulane

Jack Higgins, Higgins Industries of New Orleans, was the guest speaker at the Nov. 6 meeting of the **TULANE BRANCH**. He spoke on the development of the Higgins boats, making particular mention of torpedo and landing boats. A motion picture concluded the talk.

TORONTO BRANCH reports a record membership of 89 students. At the meeting on Nov. 13, Prof. G. Ross Lord, spoke to the Branch on "Mining Ventilation," citing his experiences with ventilation problems in Canadian mines and the troubles experienced due to winter conditions.

TUFTS BRANCH has instituted a series of meetings featuring student members as speakers. The first speaker in this series was Al Schaal, who spoke at the Nov. 13 session on "Tooling Problems in Production," based on his experience in the production-engineering department of Pratt & Whitney Aircraft Corporation.

VILLANOVA BRANCH held a joint meeting with the A.I.Ch.E. on Nov. 24 for the showing of a motion picture on alloy steel, covering the refinement of the ore, the alloying, and the heat-treatment.

Baseball Manager Speaks to Washington University Branch

WASHINGTON UNIVERSITY BRANCH (St. Louis) held a banquet on Oct. 31 at which the guest speaker was Branch Rickey, general manager of the St. Louis Cardinals Baseball Club. He spoke on the relation of the present emergency to engineers and on sports. Another guest was Prof. Raymond R. Tucker, former smoke commissioner of the City of St. Louis, who has just joined the department of mechanical engineering at the University.

Members of the Student Branch at **WORCESTER TECH** attended a meeting on December 9 of the A.S.M.E. Local Section at Worcester upon special invitation. J. E. Tolby addressed the joint meeting on "Recent Improvements in the Utilization of Coal." At the December meeting of the Branch two student papers were presented, one by John M. Townsend, '42, on "Sewer Construction," and the other by George Williams, '44, on "Shoe Manufacture," with the U. S. Steel film "Steel, Man's Servant" an added attraction. The Branch is very proud of the fact that it is the first group at Worcester Tech to have over 100 members in the Student Branch.

YALE BRANCH reports that at the Nov. 4 and 11 meetings, papers were presented by McCluskey, Gravely, Keating, McAndrews, Josephs, Gerling, Fabian, Devine, Coykendall, and Clark.

A.S.M.E. Local Sections

Coming Meetings

Anthracite Lehigh Valley. January 23, at Allentown, Pa. Subject: "Survey of National Defense Work by Colleges and Industries." The subject will be presented by Prof. Paul B. Eaton, Lafayette College, and Prof. F. V. Larkin, Lehigh University.

Central Indiana. January 9. Indianapolis Athletic Club at 6:30 p.m. Subject: "Plastics," by Harry McGowan, Bakelite Corp.

Detroit. February 3. Horace H. Rackham Educational Memorial. Subject: "New Automatic Telephone Exchange for Detroit," by J. T. Tebo, Bell Telephone Laboratories, New York, N. Y., and H. G. Mehlhouse, Western Electric Co., Inc., Chicago, Ill.

Greenville. January 21. Poinsett Hotel, Greenville, S. C. Subject: "Home Defense," by Maxwell C. Maxwell, assistant to the president, Yale & Towne Manufacturing Co.

New Haven. January 20. Mason Laboratory, Yale University. Joint Meeting with the Connecticut Chapter Society for Advancement of Management under the auspices of the Society for Advancement of Management. Panel Discussion led by A. G. Grace, Commissioner of Education, State of Connecticut. Subject: "Youth, the Schools, and Industry." This is a continuation of a similar meeting held in January, 1941.

Norwich. January 22. New London Junior College. Subject: "Heat-Treatment of Steel," by Dr. Richard F. Miller, research laboratory, U. S. Steel Corporation.

Philadelphia. January 27. Philadelphia Engineers Club, Philadelphia, Pa. Subject: "High-Speed Photography," by Prof. Harold E. Edgerton, department of electrical engineering, Massachusetts Institute of Technology, Cambridge, Mass.

Rock River Valley. January, 1942, at Hilton Hotel, Beloit, Wis. Subject: "Some Phases of Diesel Engineering."

San Francisco. January 25. Engineers Club, San Francisco, Calif. Founders' Day Banquet in which all the engineering societies of the community take part. The Hon. Herbert Hoover will be the speaker.

Washington, D. C. January 8. Potomac Electric Power Co. Auditorium, 10th and E Sts., N. W., Washington, D. C. Annual Ladies' Night Meeting. Dr. Lillian M. Gilbreth, president, Gilbreth Inc., Bloomfield, N. J., to be speaker.

West Virginia. January 27. The Daniel Boone Hotel, Charleston, W. Va. Subject: "Ramifications of the Hot Water Softener," by C. E. Joos, Cochrane Corp., Philadelphia, Pa. Mr. Joos will tell of the history of the process, its development, design of equipment.

Men and Positions Available

Send Inquiries to New York Office of Engineering Societies Personnel Service, Inc. This service is operated on a cooperative, nonprofit basis whereby those actually placed in positions by the Service agree to contribute to help maintain this service

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MEN AVAILABLE[1]

MECHANICAL ENGINEER, 29, married. P. E., N.Y. State. Eight years' field and design experience steam power-plant equipment. Interested in engineering openings in Latin America. Fluent Spanish. Now employed. Me-715.

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PLANT MANAGER-SUPERINTENDENT with thorough experience in building, organization, modern plant to delivery of finished

(*A.S.M.E. News continued on page 90*)

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[1] All men listed hold some form of A.S.M.E. membership.

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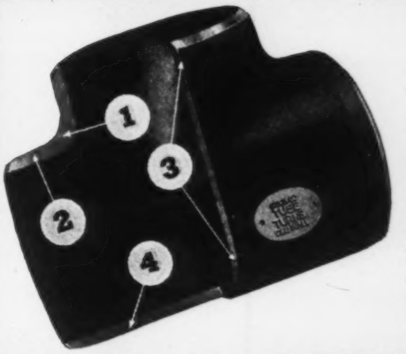
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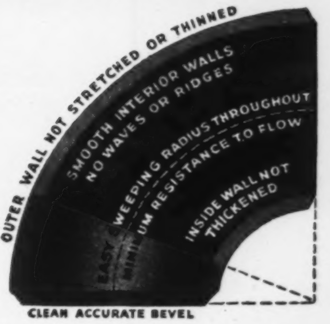
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product. Thorough mechanic and seasoned executive. Record and credentials high order. Me-717.

Pump Engineer, 29; B.S. in mechanical engineering. Experienced in research and development of rotary pumps, high vacuum, fuel oil, lubricating oil. Me-718.

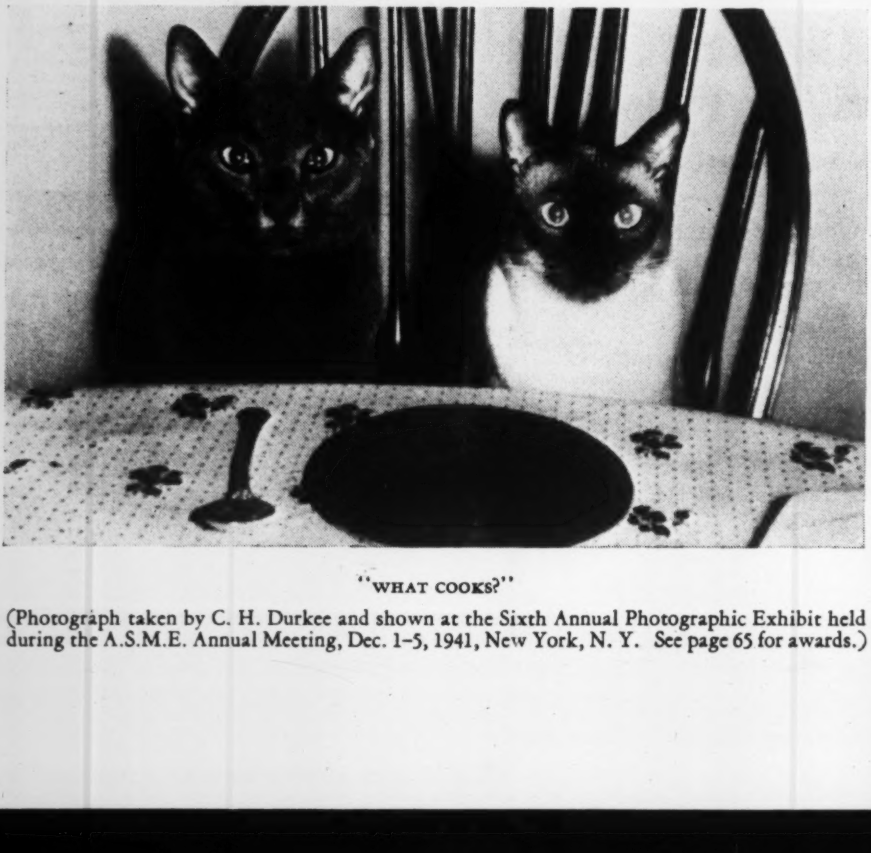
Mechanical Engineer proficient in internal-combustion engines, Diesel, electrical machinery. Oil burning industrial and domestic. Marine tank-ship experience. Affable, exacting, thorough, capable, good producer. Prefer New York metropolitan location. Me-719.

Graduate Mechanical Engineer, 44, assistant plant superintendent charge field-engineering construction, maintenance, three years; seven years draftsman and designer, cement, concentrating mills, boiler, pump, compressor plants, most experience on piping, pumps, concrete, and stress analysis, field maintenance, and construction. Licensed structural engineer. Me-720.

Mechanical Engineer with 11 years' experience in production, assembly, and testing machinery, woodworking, chemical and textile processes and equipment, and familiar with supplies of many types of equipment; wide sales experience; desires purchasing position with responsibilities. Prefers Midwestern location. Me-721.

Mechanical Engineer; 20 years responsible charge in steam power, heating, refrigeration, water supply, and sewage. Now employed as municipal consultant. Available for full or part-time work; licensed professional engineer. Me-722.

Mechanical Engineer, 35, employed as plant engineer; 11 years' broad plant engineering experience, all phases of steel-mill operation, maintenance, construction and installation, investigations, cost estimates and control, plant protection, combustion, oxyacetylene and electric-arc cutting and welding processes, steam and power plants, automatic controls, lubrication, etc. Desire plant-engineering connection. Me-723.



"WHAT COOKS?"

(Photograph taken by C. H. Durkee and shown at the Sixth Annual Photographic Exhibit held during the A.S.M.E. Annual Meeting, Dec. 1–5, 1941, New York, N. Y. See page 65 for awards.)

Engineering Manager, 25 years' experience directing the work of many engineers and men working on design, construction, and operation of manufacturing plants, industrial power plants, and mining properties. Me-724.

POSITIONS AVAILABLE

Graduate Mechanical Engineer with good basic economic training either through educational courses or experience with specifications and production procedure involved in metalworking industries. Applicant will estimate from plans and specifications materials required for completion of work. Some statistical experience would be desirable. Salary $5000–$7000 year. South. Y-9358.

Works Manager, 35–50, graduate mechanical engineer, experienced in handling fairly large manufacturing organization of approximately 1500 employees. Experience in machine-shop or metal stampings desirable though not essential. Salary $7500–$12,000 year. New England. Y-9365.

Production Manager, 35–50, to head and direct production planning and control activities in company's plants. Prefer man with industrial or mechanical-engineering degree. Should know machine-shop practice and job-lot manufacture of heavy equipment of high-precision character. Should have knowledge of industrial-engineering and cost-finding departments. Must achieve coordination between sales requirements and completion of manufacturing orders in accord with shipping requirements. Experience as production manager, assistant production manager, or superintendent in company having comparable manufacturing problems desirable, provided it has kept man abreast of best modern practices in all phases of planning and control. Salary $6000–$7500 year. Interviews, New York, N. Y. Y-9404.

Industrial Engineer, 35–50, to head, coordinate, and direct industrial-engineering activities in company's plants. Prefer man with industrial or mechanical-engineering degree. Should understand how to coordinate design engineering with production and know importance of economy in manufacture of correct processing and tooling. Should know methods analysis and the establishment of standards, to use them to best advantage for rate setting, costing, and operating controls. Should have experience in solution of problems involving material handling and usage. Salary $6000–$7500 year. Interviews, New York, N. Y. Y-9405.

Mechanical-Industrial Engineer, 30–40, experienced in production and industrial engineering with some sales experience. Salary open. Permanent. Pennsylvania. Y-9413.

Factory Manager, graduate mechanical engineer with previous experience managing large plant, preferably manufacturing small instruments or parts. Should be thoroughly versed in production, planning, cost control, tooling, tool design, etc. Salary open. East. Y-9416.

Graduate Mechanical Engineers with considerable amount of industrial background in plant-layout work or machine-design experience for large new shell-loading plant. If applicant is now employed by firm directly connected with national-defense project, he must secure written release from such employer. Write for application blanks of company. Salary $3000–$6000 year. Southwest. Y-9424-C.

Mechanical Engineer, not over 32, for work in plant operation and maintenance. Should be graduate with 5 to 7 years' experience in industry, preferably mill work. Salary $2400–$2700 year. California. Y-9444-S.

Graduate Mechanical or Electrical Engineer, preferably with master's degree and good working knowledge of electronics. Diesel-engine experience desirable. Man would be in charge of all experimental engine instruments and responsible for their operation and maintenance. A knowledge of photography sufficient to take and process oscillographic records would be desirable. Salary $3000–$3600 a year. Middle West. Y-9446-C.

Machine Shop Superintendent, not over 50, for small machine job shop. Need not be graduate engineer but must be practical man who has worked on bench as machinist or toolmaker to foreman; must also be able to estimate machine time. Salary $5000 year. Pennsylvania. Y-9462.

Development Engineer with thorough training in machine design to develop line of new machines for industry rather conservative in accepting new ideas. Must be able to work out own ideas and take entire responsibility for work. Permanent. Salary open. Headquarters, New York, N. Y. Y-9463.

Market Analyst, 30–35, preferably graduate mechanical engineer. Must be capable of making preproduction field surveys and presenting findings in understandable form. Will be required to analyze dealer and distribution contracts from engineering viewpoint and will deal with executives and workers. Applicant must have sound industrial background. Salary $5000 year. Permanent. East. Y-9471.

Mechanical Engineers, 35–45, with indus-

(*A.S.M.E. News continued on page 92*)

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